Apollo Lunar Surface Experiments Package

Monthly Progress Review

March 1972

BSR-3299

Contract NAS9-5829

Approved:

U.S. GOVERNMENT AGENCIES AND CONTRACTORS ONLY

Program Director

OFFICE OF PRIME RESPONSIBILITY

Prepared for

NASA/Manned Spacecraft Center

by

Bendix Aerospace Systems Division

ALSEP MONTHLY PROGRESS REPORT

March 1972

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SECTION I

ALSEP PROGRAM STATUS AND PROGRESS SUMMARY

Apollo 17 (Array E)

The preliminary QTRR for Subpackage 2 was held 1-2 March at BxA. Readiness to perform the Subpackage 2 acceptance level mechanical tests (and their associated functional tests) was established and these tests were subsequently completed. All Subpackage 2 hardware is complete.

After completion of the IST (with IPU) of the Subpackage 1 Qualification model (Central Station), the interim components (data processor SN-14 and command decoder SN-13) were removed on 18 March. The PCU/PDU component was removed also to permit incorporation of the 5v delay module into the PDU (reference: DR AC4168).

Retrofit and acceptance tests of command decoder SN-11 were completed 30 March. This component is scheduled to be installed into the final Qual Central Station configuration on 4 April.

The other retrofitted components, data processor SN-14 and the PCU/PDU, are scheduled for installation in the final Qual Station on 5 and 6 April, respectively.

Flight Subpackage 1 was completed 7 March in the clam shell configuration with an interim Central Station. Interim components, command decoder SN-12 and data processor SN-15, will be replaced following integration of experiments and the IST (with IPU); at the same time, a 5v delay module will be incorporated into the PDU to prevent relay scrambling and insure proper status during turn-on. Functional test of the interim Central Station was completed 8 March. Other tests accomplished were: Central Station verification and calibration, Central Station EMI, and electrical integration of LMS, LSP, and HFE.

Flight Subpackage 2 mechanical hardware is complete.

LSP - Two Prototype Explosive Packages (EPs 5 and 9) were successfully detonated 27 March at WSTF. Two others (EPs 7 and 10) deployed at WSTF failed to fire, and these were recovered, disassembled, and the E & SAs returned to BxA for failure analysis.

Design limit vibration and shock tests were completed successfully on eight Prototype EPs.

The Qualification model Central Electronics, Geophone Module, and Transmitting Antenna were integrated with the interim Qual Central Station and successfully completed EIT, C/S EMI, and IST.

Apollo 17 (Array E) (Continued)

Nine battery timers and five slide timers were installed in Qual model EP baseplate assemblies. Timer availability is the constraint factor in completing all the baseplate assemblies. Timer time-out tests were completed on three Qual EPs in March.

Flight Central Electronics, Geophone Module, and Transmitting Antenna were integrated with the interim Flight Central Station and successfully completed EIT and C/S EMI.

Flight EP baseplate assemblies were completed to the point where they are ready for timer installation. Timer availability, however, is also a constraint factor in completing the Flight baseplate assemblies.

The following data and recommendations resulting from a special timer evaluation were given to NASA/MSC on 29-30 March:

- basic timer design is simple, with inherent reliability
- small faults in the design, however, collectively remove all the performance margin; i.e., any small assembly problem would result in failure of the timer to operate
- BxA recommended changes to improve the margin so that the timer will not be supercritical to minor assembly anomalies.

The decision was made to rework all prototype, qual and flight timers.

A plan was developed to solve deployment problems experienced with EP receiving antennas; salient provisions include:

- detailed inspection of antennas to detect marginal slot to end to tube dimensions or marginal ID to OD difference conditions.
- tubes not satisfying the new inspection requirements will be reworked
- inspected and reassembled antennas will be subjected to a 20-pound acceptance test on the last four sections.
- two qual model antennas will undergo a qual-level pull force test of 25 pounds.

LEAM - The integrated system test of the Qualification model was successfully completed. Test data revealed, however, that squib circuits used to release the dust covers were incorrectly wired. A design change corrected both the Qual and Flight assemblies.

Apollo 17 (Array E) (Continued)

Assembly of the Flight electronics (using new multilayer board No. 2347001) was accomplished, but subsequent test data showed the board to have been incorrectly manufactured. Following analysis, corrective action was instituted to ensure proper assembly by Vostron. To facilitate experiment testing, the original Flight board (by Time-Zero) was reinstalled.

LMS - Final assembly of the Qualification model was completed, and the following tests were performed: (1) PIA, (2) Mass Properties, (3) experiment integration with the Central Station, and (4) integrated systems test with ALSEP.

Flight model accomplishments included completion of hot/cold/ambient testing and EIT with the system of the Flight electronics assembly. Subsequently, the flight electronics unit was disassembled and the analyzer and associated electronics were shipped to UTD for multi-energy mode modifications. The CDR for this modification was consummated, design and documentation finalized, and assembly and test of flight emission control PCBs for both Qual and Flight models completed. A potential arcing problem (between the standoffs and the high voltage track in the PCB) was eliminated following initial testing.

LSG - The Qualification Heater Box assembly was delivered to ADL 3 March, and the Qualification Electronics package was delivered there on 15 March. Integration of the sensor package and the electronics package was completed. Qual model Electronics package tests completed were: acceptance functional, acceptance level and design vibration, post-vibration functional, and noise.

The completed Qual experiment is scheduled to be delivered to BxA 20 April.

Assembly of the Flight model was accomplished 27 March.

Results of noise testing of the Flight electronics demonstrated attainment of the design goal for frequencies greater than 0.2 cpm, with the peak power spectra 13 db below the specification limit (Qual model noise test results were similar).

HFE - Flight EIT of HFE SN-7 was begun 15 March. A saturated data condition was recorded on Probe 2 thermocouple channel outputs, and trouble-shooting (DR AC4504) is continuing.

Apollo 16 (Array D)

All Apollo 16 ALSEP Flight hardware - except the FCA - is installed in LM-11 and ready for launch.

Apollo 16 (Array D) (Continued)

The Delta CF^2 was held 3 March. Astronauts Duke, Young, Mitchell and Haise operated the improved ASE pallet, performed the HFE probe/drill stem fit check, and approved all decals. All agenda items were completed satisfactorily.

Magnetic surveys of Subpackages 1 and 2 were completed 8 March.

Flight preparation of the Cask Assembly (removal of strain gage leads, weighing, photo documentation) was completed 17 March.

The following milestones remain:

Install FCA on LM-11 (15 April)
Launch (16 April).

Supporting ALSEPs on the Moon

Apollo 15 (Array A-2) - This ALSEP, enduring its ninth lunar noon, is performing normally. Some 7000 commands from Mission Control Center have been successfully executed. Downlink signal strength continues steady after 244 days of operation. RTG power output averages 73.5 watts (initial turn-on value was 74.1 watts).

All science sensors functioned properly.

Apollo 14 (Flight 4) - This scientific lunar laboratory has completed 420 days of operation on the moon, and is currently monitoring its 15th lunar noon. Approximately 5600 commands from Mission Control Center have been performed. Downlink signal strength is steady, and RTG power output is 71.5 watts (initial turn-on value was 72.5 watts).

Investigation of unexpected changes from operational power to standby power by the CPLEE and SIDE/CCGE experiments is underway. This problem was first experienced 29 March.

Scheduled ASE listening mode operations were conducted successfully on 3, 10 and 24 March.

Apollo 12 (Flight 1) - This ALSEP is performing normally during its 30th lunar noon. Over 12,800 commands from Mission Control Center have been completed during 863 days of operation. Downlink signal strength is steady, and RTG power output is 70 watts (initial turn-on value was 74.2 watts).

The 50th spurious command, which occurred in March, was corrected readily by ground command.

Internal
Memorandum

Bendix Aerospace Systems Division

Date 10 April 1972 Letter No. 975-2550 Ann Arbor Michigan

To T. Fenske

From B. J. Rusky

Subject Apollo 16 ALSEP (Array D), March Status Report

Operations at KSC to check out and ready Apollo 16 ALSEP proceeded on schedule for a 16 April launch. Activity highlights accomplished in March and the schedule for completing the remaining activities are summarized as follows:

The Delta CF^2 was held on 3 March. Astronauts Duke, Young, Mitchell, and Haise were present; they operated the ASE pallet, performed the HFE probe/drill stem fit check, and approved all decals. All items on the Delta CF^2 agenda were satisfactorily completed.

Magnetic surveys of Subpackages 1 and 2 were performed on 7 and 8 March respectively. Subpackage 1 was degaussed only in the Y axis since that was the only out-of-tolerance measurements. Another magnetic survey was subsequently performed on Subpackage 1 and all measurements were within tolerance. It was not necessary to degauss Subpackage 2 since all measurements were within tolerance. At the conclusion of the degaussing activities, magnetic trace recorders were temporarily attached to both booms to record maximum magnetic fields until LM installation. These recorders were removed on 21 March when the subpacks were installed in LM and forwarded to Ames for analysis.

Hyper 2 was cleaned and the grounding system checked on 8 March and found satisfactory for GLA installation. Subpackage 1 and GLA (SN20) were moved to Hyper 2 on 10 March, and Subpackage 1 was also partially unstowed on 10 March in preparation for GLA installation. The GLA was satisfactorily installed in the Apollo 16 Mortar Package Assembly on 13 March including installation of the GLA protective covers (CRD's 61014 and 61018).

X-rays of the Thumper ASI Selector Switch, the J-56 connector, and the safe-arm switch were taken on 14 March. All X-rays were satisfactory and inspected by the GLA project engineer, NASA project engineer, and KSC R&QA. The ASI Selector Switch X-ray shows no brass pin in the conductive bar and sufficient clearance (0.17") between the conductive bar and the common wiper. The J-56 connector X-ray shows that the connector is properly mated and the safe-arm switch X-rays show no evidence of solder balls within the switch.

The ASE pallet was satisfactorily fit checked with the MPA with live grenades installed on 14 March, and the MPA and Thumper were restowed on Subpackage 1 on 15 March.

An additional HFE probe/drill stem fit check was satisfactorily performed on 16 March. The fit check was required because of the decision to fly the back-up core stems on Apollo 16. After the HFE probe box was restowed, Subpackage 2 was weighed and installed in the pad GSE container on 17 March.

PSE caging pressure checks were made on 17 and 21 March with the following results:

223.2 MV (uncorrected)	345.8 PSI (corrected)	76°F
225.5 MV (uncorrected)	350 PSI (corrected)	70°F

The preparation for flight tasks were satisfactorily completed on both subpackages on 17 March and photographs of each side of both subpackages were also taken.

The ALSEP Cask Assembly was prepared for flight on 17 March which included removal of the strain gage leads, photographs, and weighing.

The System Test Set was readied and shipped to Ann Arbor on 27 March and arrived on 29 March.

BxA personnel supported GE during FCA loading for the CDDT on 28 March. The ACA protective cover was removed prior to and subsequent to FCA loading; after FCA removal and ACA dome replacement the ACA was inspected. The result was that the ACA is in its flight configuration and ready for flight. The ACA protective cover was re-installed on 31 March after the CDDT recycle.

At this time all the Apollo 16 ALSEP flight hardware is installed on LM-11 and is ready for launch except for installation of the FCA.

The plan for completing the pre-launch checkout and installation operations at KSC for Apollo 16 is as follows:

Install FCA on LM-11	15 April
Apollo 16 Launch	16 April

B. J. Rusky, Manager
ALSEP System Support

BJR/ram

Internal
Memorandum

Bendix Aerospace Systems Division

Date 6 April 1972 Letter No 9703B-91 Ann Arbor Michigan

To T. W. Fenske

From V. J. Jansen

Subject ALSEP Array E System Qualification Model, March Status Report

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3.0 Summary of Array E System Qual Model Status & Progress

Subpackage I, in the "clam shell" configuration with the interim Central Station was initiated into its system test program 29 January 1972, with completion of the Central Station Functional Test on 30 January.

Data Processor, S/N 14, and Command Decoder, S/N 13, are the interim components that were installed in the interim Central Station, and were removed on 18 March following completion of the IST w/IPU test for retrofit and acceptance testing. The PCU/PDU was also removed on 18 March to incorporate the 5 volt delay module into the PDU (Ref. DR AC 4168).

Retrofit and Acceptance testing of C. D. S/N 11 was completed on 30 March.

Plans for April include completion of acceptance testing of DP S/N 14, and PCU/PDU at the component level and installation into the Central Station. Central Station functional and verification test will be performed subsequent to final assy of C/S and prior to stow of SP I for Mechanical Testing at acceptance levels. System level tests through completion of MIST, following SP I Mechanical Tests at acceptance levels, are scheduled for completion during April. System EMI is scheduled to start on 26 April 1972.

The Preliminary QTRR for Subpackage II was held at BxA on 1-2 March 1972, and established readiness to perform the SP II Acceptance Level Mechanical Tests and their associated functional tests only. These tests were completed during March.

The Preliminary QTRR for SP I and relevant SP II hardware is scheduled for 10 April 1972. The purpose of this Preliminary QTRR is to establish readiness to perform the SP I Mechanical Tests at acceptance levels including their associated Post-Vibration Functional Tests and also System EMI.

The QTRR for SP I and SP II is scheduled for 4-5 May 1972.

D

3.1 Array E System Qual Model Discussion

3.1.1 Subpackage I Qualification Model

Subpackage I, in the "clam shell" configuration with the interim Central Station was initiated into its system test program on 29 January 1972. Integration (EIT) of LSPE was completed on 7 March and C/S-LSP, S/N 5 was completed on 15 March, thus completing integration of all Qual Model experiments.

The IST w/IPU test was completed on 18 March, thus completing the system tests scheduled to be performed prior to change out of the interim C/S components; i. e., Command Decoder and Data Processor, and also incorporation of the 5-volt delay module in the PDU.

The DP, C. D., and PCU/PDU were removed from C/S on 18 March for retrofit and acceptance testing prior to final installation into the Qual Central Station.

The status and plan for these C/S components is as follows:

A. Command Decoder, S/N 11

CD, S/N 11, has been retrofitted with the new Control Logic boards, Part No. 2370075, S/N 1 and S/N 2, and subjected to an inprocess ambient functional, followed by a hot, cold, ambient functional, operating vibration at acceptance and design limit levels and post-vib functional test. Acceptance tests were completed on 30 March 1972.

The 2370075 Control Logic boards were reworked; i. e., drilled to eliminate short and hard wired in accordance with CRN 70700 to provide proper circuit configuration.

CD, S/N 11, is scheduled for installation into the Central Station on 4 April 1972.

B. Data Processor, S/N 14

DP, S/N 14, has been retrofitted with the new Timing and Control board, Part No. 2349450, S/N 1, and subjected to an in-process ambient functional, followed by a hot, cold, ambient functional test. The operating vibration at acceptance and design limit levels was started on 30 March 1972.

The DP Mother Board, Part No. 2349474B, S/N 2, that includes the potential single point failure and has been installed in the Data processor during all system tests to date will not be changed out as previously planned. DR AC 4992 was written on 20 March to document anomalies on the redesigned DP Mother Board 2349474-502, and dispositioned to strip down to the 2349475 P. C. board level and release boards to Engineering for evaluation.

Plans for April include completion of Op. Vib. and Post-Vib. ambient functional. DP, S/N 14, is scheduled for installation into C/S on 5 April 1972.

C. PDU, S/N 13

PDU, S/N 13, was reworked to incorporate the 5-volt Delay Module and subjected to an inprocess ambient functional test. The ambient portion of the ambient, cold, hot functional test was completed on 30 March.

Plans for April include completion of the hot, cold, ambient functional test on PDU, final assembly of PDU, S/N 13, with PCU, S/N 11, Op. Vib. and Post-Vib. functional of the PCU/PDU assembly. The PCU/PDU is scheduled for installation into C/S on 6 April 1972.

The Preliminary QTRR for SP I and relevant SP II hardware is scheduled for 10 April 1972. The purpose of this Preliminary QTRR is to establish readiness to perform the SP I Mechanical Tests at acceptance levels including their associated Post-Vib. functional tests and also System EMI.

The QTRR for SP I and SP II is scheduled for 4-5 May 1972.

Plans for April include the following:

A. Complete Acceptance Tests of DP, S/N 11 and PDU, S/N 13.

B. Final assembly of Central Station

C. C/S Functional and Verification

D. Stow SP I

E. Mass Props

F. Vibration, Acceptance Level

G. Tumble

H. Boyd Bolt Verification and Fit Check

I. MIST (LMS on Vacuum Cart)

J. System EMI

LSG, S/N 2, is scheduled to be completed at ADL and delivered to BxA on 18 April. The LSG is scheduled to complete its acceptance tests at BxA and be available to the ALSEP System on 27 April prior to start of system EMI. The LSG Mass simulator will be stowed on SP I for the acceptance level mechanical test. LSG, S/N 2 will be stowed on SP I for design limit vibration and shock test.

LMS and LSPE are available for stow on SP I.

3.1.2 Subpackage II Qualification Model

The Preliminary QTRR for SP II was held at BxA on 1-2 March and established readiness to perform the SP II acceptance level mechanical tests and their associated functional tests only. The SP II configuration for these tests included stow of the LEAM Dynamic Simulator in lieu of the LEAM, S/N 2, Qual Model which was at that time in troubleshooting to isolate an intermittent anomaly.

The following Qualification tests were completed:

A.	SP II Mass Props	6 March
B.	SP II Vibration, Acceptance Level	8 March
C.	SP II Tumble	9 March
D.	SP II Boyd Bolt Verification	9 March

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E. Antenna Aiming Mechanism Functional 16 March

F. RTG Shorting Plug Functional 15 March

The LEAM, S/N 2, Qualification Model is complete, thus completing all SP II hardware.

Plans for April include use of relevant SP II hardware in the System EMI Test.

The QTRR for SP I and SP II is scheduled for 4-5 May 1972.

V. J. Jansen, Model Manager
ALSEP Array E Qual System

VJJ/jh

cc: H. Reinhold

Internal
Memorandum

Bendix Aerospace Systems Division

Date 7 April 1972 Letter No. 9703-700 Ann Arbor, Michigan

To T. W. Fenske

From R. Christian

Subject ALSEP Array E Flight Model March Status Report

3.2 SUMMARY OF ARRAY E FLIGHT MODEL STATUS AND PROGRESS

Subpackage I in the "clam shell" configuration with the interim Central Station completed Functional Test on 8 March.

Command Decoder, S/N 12, and Data Processor, S/N 15 contain interim assemblies presently installed in the Central Station. These interim assemblies will be replaced following IST w/IPU.

C/S Verification and Calibration Test, C/S EMI, and electrical integration of LMS, HFE and LSP were completed during March.

Major mechanical hardware associated with Subpackage II is complete.

Plans for April include electrical integration of LEAM and LSG, and performance of the Integrated System Test w/IPU.

3.2.1 Subpackage I Flight Model

Subpackage I in the "clam shell" configuration with the interim Central Station was completed 7 March. C/S Function Test was completed 8 March and Verification and Calibration Test, 12 March. C/S EMI Testing was completed 23 March.

A. Central Station Components

1. Data Processor, S/N 15: The interim data processor containing a "hardware" fix that deletes single point failure causing lock-out in LSPE/ASE data formating modes was installed on Thermal plate. Upon availability of new mother board, the interim data processor will be removed from Central Station and a new timing and control module and the mother board installed.

2. Command Decoder, S/N 12: The interim command decoder, containing DVM control logic boards and hard-wired Command Sequence and Data Demodulator modules were installed on thermal plate. The flight modules have been assembled and tested and will be installed following completion of IST.

3. PDU, S/N 14: A 5-volt delay module will be incorporated into the PDU, which will prevent relay scrambling and insure proper status during turn-on. The new PC board for the 5-volt module is scheduled to be delivered 14 April.

Plans for April include PDU final assembly, and completion of hot, cold, and ambient functional testing.

B. Major Structural Items

All major structural items are complete.

C. Flight Experiments

1. LSG, S/N 3: Experiment was received at BxA on 6 April. EIT is scheduled to begin 11 April.

2. LMS, S/N 7: Completed EIT on 9 March. Subsystem acceptance tests and integration into the flight system following Multiple Energy Mode Change Modification is scheduled for 6 May.

3. LEAM, S/N 3: Experiment Integration Test began 7 April.

4. HFE, S/N 7: Experiment Integration Test completed 17 March.

5. LSPE: Experiment Integration Test completed 21 March.

3.2.2 Subpackage II Flight Model

The status of the major items of SP II is as follows:

A. RTG, S/N 6320014: Available for Flight System

B. LEAM, S/N 3: See status under experiment Section 3.2.1-C, Paragraph 3.

C. HFE, S/N 7: See status under experiment Section 3.2.1-C.

D. Shorting Plug, S/N 12: Complete

E. Antenna Aiming Mechanism, S/N 12: Complete

F. Aiming Mechanism Container: Complete

G. Pallet Assembly, S/N 13: Complete

H. HFE Subpallet Assembly, S/N 8: Complete

I. Carrier Subpallet, S/N 6: Complete

R Christian

R. Christian, Model Manager
ALSEP Array E Flight Model

RC/jh

Internal
Memorandum

Bendix Aerospace Systems Division

Ann Arbor, Michigan

Date April 17, 1972 Letter No 9713-552

To T. W. Fenske

From H. R. Howell

Subject ALSEP Array E Central Station Components Monthly Progress Report March 1972

4.0 CENTRAL STATION COMPONENTS

4.1 Qual Central Station

The interim Phase I Qual C/S successfully completed EIT and IST.

During the retrofit of the Phase I DP, CD and PDU, several problems were encountered with the new PC boards due to artwork errors.

Due to the long-lead time of procuring new PC boards, it was decided to rework the DP Timing and Control and C/D Control Logic PC Boards to use them for Qual/Flight and spare units. The +5-volt delay module PC board with unplated through holes will also be used for the Qual PDU.

The Pre-qual D/P Motherboard with the single-point failure potential was also used in the Qual D/P.

New PC boards have been designed and are under procurement for the 5-volt Delay module and the Data Processor Motherboard. These new boards will be used on Flight and Spare modules only.

4.1.1 Qual Command Decoder

The new control Logic PC boards failed test. Troubleshooting revealed a shorted and open circuit condition within the PC board.

The PC board was successfully reworked by milling-out the shorted circuit and hardwiring for the open circuit.

The Qual C/D successfully completed acceptance test and operating vibration. Unit was reinstalled on the Qual C/S.

4.1.2 Qual Data Processor

New Motherboard with the single-point failure fix incorporated was received but again failed test due to open circuits in the PW board due to artwork errors.

The Pre-qual Motherboard with the single-point failure potential was used for the final Qual Motherboard.

The new Timing and Control Module PC Board failed test due to an open circuit in the PC board also due to artwork errors.

The Timing and Control PC Board was hardwired to correct for the open circuit and successfully completed test. The use of an interrupt pad was also necessary.

The Qual D/P was assembled, successfully acceptance tested and operating vibration performed. Unit was reinstalled in the Qual system.

4.1.3 Qual PDU

The +5 delay module was assembled and successfully completed. testing.

Investigation of the new +5 delay module PC boards revealed that the circuit holes were not plated through.

A decision was made with MSC's concurrence to use the existing +5 volt-Delay module for Qual only and procure new boards for Flight and Spare.

The redesign effort on the new boards was completed and new boards are due in house on 4-15.

The Qual PDU/PCU completed acceptance testing and operating vibration successfully and were reinstalled on the Qual Station.

4.2 Flight Central Station

The Flight Central Station is presently in System test with the pre-flight C/D, D/P and PDU installed. These units will be removed retrofitted and reinstalled on the Station. Scheduled completion is 5-6-72.

4.2.1 Flight PCU

The Flight PCU module/housing misalignment problem has been isolated to two modules being assembled improperly causing an overall demensional problem.

The decision to rework the housing or make new modules is presently being investigated.

The Flight PCU will be reworked during the retrofit of the Flight Station.

4.2.2 Pre-Flight Command Decoder

This model will be retrofitted with the reworked Control Logic modules (same as Qual) during the retrofit of the Central Station.

4.2.3 Pre-Flight Data Processor

Unit will be retrofitted with the new motherboard assembly to eliminate the single-point failure potential.

The Timing and Control modules hardwired (same as Qual) will also be installed. Scheduled completion of rework is 5-6-72.

4.2.4 Pre-Flight PDU

The +5 volt Delay module PC boards are on procurement with a delivery date of 4-15-72.

Upon receipt of the boards the module will be completed and installed in the Flight PDU. Scheduled completion of the Flight PDU retrofit is 4-5-72.

4.3 Array E C/S Components to Complete

Flight D/P

2349480	Motherboard Assy	New PC Board Ship date of 4-20

Flight PDU

2362800	+5 Volt Delay	New PC Board Ship date of 4-15-72

Spare D/P

2349480	Same as Flight	
2349485-SN-5	Sequencer	Microcircuits received in-work
2349465-SN-3	Signal Conditioner	In IPT #1

Spare C/D

2367652-SN-13	Data Demodulator	Assembled ready for IPT #1
2370075-SN-5	Control Logic	In IPT #1
2370079-SN-6	Control Logic	Assembled Ready for IPT #1

Spare PDU

2362209-SN-3	Motherboard	On DR-AC4698 Lifted Pads
2362260-SN-9	D/P Module	Thermal Base Out for Gold Plating
2362800-SN-10	+5 Volt Delay	New PC Board Ship date of 4-15

Spare PCU

2368110-SN-3	Motherboard	On DR-AC4758 lifted pads
2370050-SN-3	Switching Mod.	Rework to DR AC-4793
2370060-SN-7	V/R Mod.	Rework to DR-4994 completed, in conformal coating

H. R. Howell

H. R. Howell

DD:cc

Internal
Memorandum

Bendix Aerospace Systems Division

Date 4/6/72 Letter No 9712-888 Ann Arbor, Michigan

To T. W. Fenske

From J. L. McNaughton

Subject ALSEP Structural/Thermal/Crew Engineering March Monthly Progress Report

5.0 STRUCTURAL/THERMAL/CREW ENGINEERING

5.1 MECHANICAL DESIGN

a. The E2E LMS Ion source cover assembly spring problem was investigated. The trainer spring is made of .032 music wire and has approximately twice the yield strength of the flight LMS spring. It was determined that the trainer spring had been mistreated and should function properly under normal training conditions. The spring will be replaced and spared for future trainer usage.

b. Changes have been costed for removal of Array E carry bar handles and clamps, and the application of Scotch tread in the handle region. These changes will not be released until approval is received from MSC.

c. Re-design of the E2E trainer UHT for added strength for the SP II carrier deployment was examined. The use of 17-7PH stainless steel in place of 6061-T6 aluminum appears feasible.

d. Preliminary Subpack changes required for the Taurus Littrow landing site is complete. The changes include:

- Investigation of Antenna Aiming Mechanism container foam rework requirements and feasibility.
- Drawing modification required on container foam.
- Minor change to existing gnomon.

e. DR AC4790 on the Flight 6 shorting plug was resolved. The lever could not be actuated because the Vlier pin was damaged after previously having been successfully accepted. To eliminate recurrence of this type of damage, the adjustment screw will be potted over after proper installation has been verified. This action will prevent inadvertent adjustments.

f. The length of the thermistor lead on the Flight 6 primary structure right side has been changed to 36 inches (2332988-3) to permit proper thermistor assembly installation. A similar problem on QSE was solved by splicing on longer leads.

g. Array E HFE and LEAM astromates have been bonded with EA 901/B-1 adhesive to accomplish the same design improvement at the astromate connector and adapter interface as was done on the Array D HFE astromate (Ref: ECP 026).

h. LSPE antenna bracket for stress relief at the Central Station front panel has been released. Drawing effectivity is for Flt 6, QSE & E2E. The changes required to add this bracket to Subpack I are also released.

i. Review of the LSPE Explosive Pkg GAC ICD and BxA drawings has been completed. This information was discussed with J. Chandler (MSC) on 29-30 March.

j. A budgetary is in process to determine the feasibility of supplying a lighter weight carrier subpallet for E2E. Planning calls for the use of the following existing E2E designs.

- deployable subpallet
- tool supports
- deployable LEAM astromate
- Non-deployable AAM container
- Non-deployable LEAM
- simulated LEAM dust cover.

5.2 STRESS/DYNAMICS (Array E)

5.2.1 Qual E

a. Acceptance Test - Subpack No. 2

AER-487 was written defining accelerometer requirements for Qual E Subpack 2 acceptance vibration tests. Accelerometers locations correspond to EEM requirements in order to allow a comparison of data.

The Qual E Subpack 2 acceptance level vibration test was completed. No discrepancies resulted except against a simulated cable reel which came partially loose during the x-axis test. This item should have been taped down, however, no difficulties were encountered. The accelerometer data has been reduced and evaluated. The results are discussed in memo 9712-857 (dated 3/9/72). Briefly, the response levels of the subpack have been significantly reduced relative to EEM test results. Qual E subpack 2 response to design limit vibration will not exceed previous qualification or specification levels of the various components.

b. Design Limit Tests

Instrumentation requirements for Qual E Subpack 2 vibration tests are defined in AER-504. Accelerometers will be located per EEM requirements to allow direct comparison of data.

5.2.2 Astromate Anomaly

The engineering model LEAM astromate connector was epoxied (EPON-901) to the flange and tested to determine the bond strength in torsion. The results were favorable. Two trials resulted in 145 and 170 in. lb. failure torques which far exceed astromate applied loads.

5.2.3 Design Change Review

A design change to the curtain cover clip (dwg. no. 2370319) was analyzed and found to be of sufficient strength. The clip will be capable of sustaining a 3.7 lb load with a 1.15 factor of safety.

5.2.4 LSG Vibration Test Levels

Memo 9712-841 was written defining recommended non-operating acceptance vibration test levels for the LSG. Such levels are sinusoidal and derived from EEM test results.

5.2.5 LMS Qual

The LMS qual model pre-amp experienced a wire failure during design limit level operating vibration testing. Consultation with the LMS group and RALPO concerning the failure and subsequent refurbishment lead to the following conclusions:

a. The wire failure was probably a result of being pinched during the stripping operation (although no definite proof has yet been obtained).

b. The fix consisted of bonding all wiring with EPON-901 to the chassis at nine points where the wiring was routed through the chassis structure (via slots), and using conformal coating to attach the wiring to adjacent components. Although mechanical tie-downs would have been the best approach to the problem, the above fix is adequate and has minimum cost/schedule impact.

c. Since the proto model passed design limit operating vibration tests without such wire failures, it is probably true that the broken wire in the qual model was weakened during assembly. Hence, there is no need to repeat any of the vibration tests. It was agreed that the test would be resumed at the point at which it was halted.

Memo no. 9712-848 was written concerning the Qual Model LMS pre-amp wire failure. It was concluded that the problem was not due to a design deficiency and, hence, the testing should be continued from the point at which it had been stopped.

5.2.6 UHT Trainer

Material review and stress analyses have been conducted for the UHT. The purpose was to determine a relatively simple design change that would provide a "heavy duty" UHT for Trainer purposes.

A material change for the UHT body from 6061-T6 aluminum to 17-7PH (TH1050) stainless steel would increase the strength of the body by a factor of four. However, the UHT head is the "weak link" in the assembly. A material change was investigated, but the present design utilizes 17-4PH (H900) which cannot be greatly improved upon by other materials (see memo no. 9712-885).

5.2.7 EEM Vibration Test Reports

ATM-1091, "ALSEP Array E Engineering Model Subpackage No. 1 with LSG - Design Limit Vibration Test Results", and ATM-1090, "ALSEP Array E Engineering Model Subpackage No. 2 - Design Limit Vibration Test Results" have been completed and will be released early next month.

5.2.8 April Tasks

a. The Qual E subpackage 2 design limit vibration and shock tests will be witnessed and supported.

b. Qual E subpackage 2 vibration test data evaluation will be started.

c. The carry-bar static and dynamic test report will be completed.

5.3 MECHANICAL AND CREW SYSTEMS

5.3.1 Array D

a. The March Flight 5 weight status report has been completed and sent to J. Chandler/J. Bryant, NASA/MSC. The actual weight of the Flight 5 hardware was determined before being loaded on Apollo 16. This final actual weight status is reflected in table 2.

b. The Delta CF^2 was successfully performed on ALSEP modifications on 3/3. Apollo 16 Prime and back-up crew comments on the ASE subpallet and carrier modifications were very positive. All BxA Engineering action items are now closed in support of the flight.

c. The HFE (MD-53 Series) Microdot connector modification for the Astromate handle was sent to BxA/KSC personnel for incorporation.

A series of three tests were run to validate the EPON-901 bead which improved the strength of the thread bond to a torque value over 170 in. lbs. CRN 61078 has been released to the Flt #5 system.

d. Additional detailed drawings on the MPA have been sent to J. Langford/ F. Humphries, NASA/MSC in order to complete the Array D Demo Model update and fabrication. Scheduled completion date is now 3/31/72.

5.3.1.1 Array D Trainer Status

a. The pallet locks have been incorporated into the E-2D ASE MPA pallet. The acceptance test was performed on the ASE mods on 3/2/72 without any major problems. The ASE MPA pallet was then hand carried to KSC in preparation for the 3/3 deployment with the back-up crew.

b. A backup crew deployment was held at KSC on 3/3/72. Several minor problems were encountered related to stowage and procedures and hardware. The hardware deficiencies were primarily a result of the repeated usage the training unit has seen. Correction of the problem areas was coordinated with the appropriate support personnel and the necessary repairs were completed prior to the next deployment. The training exercise scheduled for 3/9/72 Prime Crew was cancelled and T. England performed a one man deployment of EVA #1 activities.

c. A back-up crew deployment was conducted on 3/21/72 at KSC. The problem areas were primarily procedural, however, two equipment failures occurred. The SP #2 Handling Assy pull pin (loop) and the ASE Thumper Power cable broke (memo 9712-878). These failures are considered a result of trainer usage and were handled as field repair items. The deployment (Prime Crew) on 3/29 was excellent, no BxA action items. The next training exercise scheduled for the Prime Crew is 4/16/72.

5.3.2 Array E

a. The ALSEP Configuration Deployment Task Sequence (ATM-1073) has been completed and distributed.

b. The ALSEP System Mass Properties Document (ATM-268) has been updated to reflect the actual weight of the Flight 5 equipment and the Array E Systems Weight Status/Estimate.

c. The latest weight data (Qual System) has been tabulated and entered in the March monthly weight report (Table 1).

d. A number of action items have been assigned as a result of the 2/29/72 E2E deployment (Ref. BxA letter no. 9712-853). All items are currently in work. Additional information has been obtained from D. Bland (CPD) concerning an action item to review the present thermal constraints for the LSPE charges. The basis for this requires is that consideration is being given to deployment of four of the charges during EVA 1.

e. The KC-135 test of the Array E ALSEP equipment involving space-suited 1/6G, tests of the carry bar, LMS breakseals, shorting plug, antenna aiming mechanism, and LSG was quite successful and is reported in memo 9712-874.

5.3.2.1 Array E Trainer Status

a. The first E-2E Trainer Mod Kit was completed on 3/2/72.

b. The ASPO Apollo #17 deployment on 2/29 provided an excellent opportunity for NASA program personnel to review the ALSEP experiments and other science requirements during a prime crew exercise.

Several action items were reviewed which resulted from procedural or hardware discrepancies.

1. LSPE/EP firing hazard visa vis orbit CSM
2. LSPE/EP Antenna separation.
3. LSPE/EP thermal constraints.
4. LSPE/EP minimum deployment distance.
5. LSPE/EP maximum (RF) distance for deployment from ALSEP.
6. LSPE Geophone flag design.
7. LSPE/EP contingency procedure if (arm) slide moves.
8. LEAM/Carrier socket location evaluation.
9. LEAM - Astromate/Microdot connector rotation (Locktite).
10. Cent/Sta separation limits from other A#17 science.
11. LMS dust cover (on orifice) requirements.
12. ALSEP geometry for Littrow to be approved by PI's.
13. Location of disposed ALSEP support hardware.
14. Evaluate carrybar without "D" handles on E2E only.

c. Following the E2E LSPE Explosive Package antenna failure which occurred during the 2/29/72 deployment, a pull test was conducted at MSC on the remaining antennas. One antenna did not survive the 15-pound pull test and broke at 12 pounds. This failure was apparently in the same location as the one during the deployment.

Both packages SN 2 & 4 were shipped back to BxA for inspection by LSPE personnel and repair. This information was coordinated with System Support and as a result, the plan to order an additional eight antennas as field spares.

d. Engineering to accomplish the May Trainer modifications, identified during the February technical review, has been completed. The corresponding changes have been released for the flight unit and are presently being prepared for the Trainer.

e. The first back-up crew E-2E deployment was conducted on 3/16/72. This deployment was shirt-sleeve and a few problems were encountered. BxA Field Personnel attended this exercise.

f. A format has been established for reporting hardware and engineering status (Ref. memo 9712-872) of the E-2E Trainer. It is anticipated that these memos will be published on a weekly basis. In addition, a weekly trainer status meeting has been established to facilitate maintenance and track updating of the hardware which includes Mod Kits.

5.3.2.2 Array E Demo Model Status

a. The Demo Model Deployment/Stowage Tasks Document has been completed and reviewed. Photos will also be used in the document to illustrate the deployment of the Demo Model.

b. Final assembly on the Demo Model was started on 3/6/72. Engineering Acceptance was successfully conducted at the Vendor's on 3/10/72. Final customer (RALPO) Acceptance was conducted on 3/14/72 at Bendix. Only four minor problems were encountered and will be repaired before shipment to KSC to support the Space Congress on 4/25/72 to 4/29/72.

c. The Demo Model was displayed in the South Conference Room of the cafeteria for approx. two weeks and is now being re-stowed in preparation for its delivery to KSC. Additional work is being done on the LMS and LEAM to show more details of the thermal control surfaces and sensors.

5.3.3 Weight

The weight status for Flight 5 and Array E are summarized below. Details on each array and for the Array E experiments are shown in Tables 1 and 2.

	Flight 5 (Array D)	Array E
Subpack I	145.80	135.65
Subpack II	88.38	99.49
SEQ Total	234.18	235.14
ACA	57.65	54.28
ALSEP Total	291.83	289.42

TABLE 1

ALSEP ARRAY E WEIGHT ESTIMATE

SUBPACKAGE #1	
C/S and LSP/CSE	43.80
Primary Structure	9.30
Sunshield Assy	10.10
Support Structure, LSG	1.60
Rear Shield	1.50
TC Curtains	2.00
Handling Assy	0.48*
PDM	1.00
Sunshield Extenders	0.90
Antenna & Cable	1.30
Antenna Mast & Support	1.20
LSG/Cable	28.20
LSP/Geo/Ant/Cable	12.20*
LMS/Cable	20.07
Miscellaneous/Fasteners	2.00
S/P #1 Total	135.65
S/P #2 Total	99.49
SEQ Bay Total	235.14
ACA Total	54.28*
ARRAY E TOTAL	289.42

SUBPACKAGE #2	
Pallet Assy	14.04*
Structure Carrier	7.06*
Shield Assy/RTG Cable	1.88*
RTG & Cable	28.15*
Shorting Plug	1.36*
ALSEP Tools	2.96*
Aiming Mechanism	1.94*
Aim. Mech. Box	2.07*
Carry Bar	3.38*
HFE Subpallet	6.74*
HFE Probes & Electronics	11.90*
LEAM/Cable & Spool	16.31*
Miscellaneous/Fasteners	1.70
SP #2 Total	99.49

ACA	
Fuel Capsule	15.25*
Fuel Cask	25.07*
Thermal Shield Structure Assy Band Assy Astronaut Protect.	13.96
ACA Total	54.28*

*actual weight.

The present weight estimate of the Explosive Package Transport Module (Stowed in SEQ #3) is 42.4 lbs.

TABLE 2

ALSEP FLIGHT 5 WEIGHT ESTIMATE

SUBPACKAGE #1		SUBPACKAGE #2		ACA	
C/S, PSE and ASE Elect	46.43*	Pallet Assembly	13.16*	Fuel Capsule	14.5
Primary Structure	9.57*	Structure Carrier	4.75	GAC Structure	5.0
Sunshield Assembly	11.22*	Shield Assembly/RTG Cable	1.70	Fuel Cask	
PSE	22.41*	RTG and Cable	28.30	Thermal Shield	
ASE/Cables	26.00	Shorting Plug	1.00	Structure Assy	38.15*
LSM	21.30*	HFE Probes & Electronics	11.70	Band Assy	
Thermal Control Curtains	2.00	HFE Subpallet	6.40*	Astronaut Protection	
Fasteners (Boydbolt)	0.80	Forward Tool Support	0.60		
EDM	0.75	ALSEP Deployment Tools	5.05*		
Sunshield Extenders	0.95			ACA Total	57.65 lbs
Boom Assy	0.48	Fasteners (Boydbolt)	0.60		
Antenna & Cable	1.25*	Antenna Aiming Mech & Box	3.32*		
Strain Relief	0.35	Miscellaneous	1.03		
Dust Cover	0.25	PSE Stool	0.44*		
Miscellaneous	2.04	ASE Modifications	10.23		
S/P #1 Total	145.80 lbs	S/P #2 Total	88.38 lbs*		

*Actual weight data.

Total SEQ Bay	234.18 lbs
ACA	57.65
ALSEP Total Weight	291.83 lbs
ALSEP Spec Weight	293.0 lbs

5.4 THERMAL DESIGN

5.4.1 Flight 1

a. Flight data listings corresponding to the 28th lunar night have been released.

5.4.2 Flight 4

a. Flight data listings corresponding to the 13th lunar night have been released.

b. Calcomp plots were generated showing Flight 4 temperature profiles of the C/S sunshield (AT01) and thermal plate (AT05) for the first 12 lunations.

5.4.3 Flight A-2

a. Flight data listings corresponding to the 7th lunar night have been released.

b. HK data plots covering the first five lunations for Flight A-2 have been generated per a request from Mission Support. Plots for lunations 6, 7 and 8 are nearing completion.

c. Long term C/S thermal performance for Flights 1, 4 and A-2 has been determined based on flight data and analytical extrapolations. For a ten year operational period only Flight A-2 is power limited. At the end of six years, A-2 will require manipulation of experiments to provide temperature control for the C/S during lunar night.

5.4.4 Array D

a. Work is continuing on the Array D Thermal Design Data Book. The document will contain results of C/S and experiment thermal design/analysis/testing and will be used for mission support purposes.

b. A final report documenting the thermal design efforts for the LSM, ASE, PSE and HFE is nearing completion. The report will predict experiment lunar performance at Descartes and will be included in the Array D Thermal Design Data Book.

c. The final Array D experiments T/V flight acceptance test report has been released. The report shows temperature profiles and lunar noon and night equilibrium test temperatures for each experiment.

5.4.5 Array E

a. Central Station - The electronic power/thermal performance study for the C/S has been completed and released. Results indicate that for a 2.9 inch wide mask, average thermal plate temperatures will nominally range between 8 and 99°F for a two year duration. During lunar noon when the LSPE is activated, the average thermal plate temperature will be 101°F. The maximum PDM panel temperature is 310°F which reflects the 14.0 watt dump and the full APM dump. Thermal performance of the C/S conforms to AL 240000 ("Structure Thermal Subsystem Specification").

b. LSG -

1. Preliminary analysis of ADL proposed insulation modification was completed and a memo was sent to Project Office. The memo stated that the ADL modification was thermally acceptable provided that the top layer of insulation was made from .002" aluminized teflon, instead of 1/4 mil aluminized mylar.

2. A thermal review and associated memo of the ADL qual and flight model sensor package thermal control tests were completed. It was concluded that the tests were generally conducted satisfactorily.

3. A detailed thermal/math model is being generated to evaluate the proposed ADL insulation edge.

4. Support was given to the LSG flight model T/V acceptance test performed at ADL. It appears that the ADL design changes made to the insulation blankets, lowers the heat leak through the insulation by nearly one watt at lunar night conditions.

5. The LSG stability criteria were reviewed and approximate teims to achieve stability (based on engineering model T/V test results) were supplied to systems engineering.

6. A memorandum was issued to define required LSG qual/flight model T/V test instrumentation.

c. LEAM -

1. The Qual/Flight radiometers with LEAM films applied have arrived from Union Carbide. The radiometers are to be incorporated in the IR calibration test which will determine the correct combination of IR lamp voltage and distance to provide one sun onthe LEAM top surface for qual and flight tests. The thermal design/analysis section is to actively participate in the calibration test.

2. Measurements have been made to obtain surface optical properties of the radiometer SiO films using the Gier-Dunkle apparatus.

3. The carbon arc lamp has been checked out for the IR calibration tests which will be performed shortly.

d. LMS -

1. The DVT final report correlating T/V test results with the analytical model is complete. Release is expected in the near future.

2. Final mask/temperature/power studies for the LMS have been completed. The studies incorporate the latest modifications in the thermal model i.e., the analyzer cover interior aluminized surface, and 1.65 watts of power dissipated in the analyzer electronics. A final radiator size of 34 in^2 results in the following temperatures.

. Qual Design Limit - (electronics 7.65w, analyzer 1.65w)	$+130^{\circ}F$
. Flight Lunar Surface - (electronics 7.65w, analyzer 1.65w)	$+123^{\circ}F$
. Qual/Flight Night Operational - (electronics 7.4w, analyzer 1.65w)	$-5^{\circ}F$
. Survival (electronics 7.4w)	$-16^{\circ}F$

A final LMS mask/power/temperature report is nearing completion.

3. The qual model analyzer cover has been coated with aluminum tape on the inside surfaces to reduce the lunar night heat leak. Emittance readings taken of this tape (G103500) indicate an ε of 0.026 which is adequate.

e. LSPE -

1. Final drawings of the qual model thermocouple locations have been approved for release.

2. The DVT final report which correlates T/V test data with the thermal math model is nearing completion.

3. The lower limit temperature level for the LSP explosive packages is being determined. It may be required that the packages be subjected to limited solar exposure during the period between LM off-load and LRV traverse.

4. A memo defining LSPE interim stowage thermal constraints prior to lunar deployment was released. The memo is in response to NASA's concern that the LSPE explosive packages may be deployed during EVA 1.

5.4.6 Plans for April

a. Flights 1, 4, and A-2: Continue to catalog and process flight data; complete calcomp plots for A-2 sixth, seventh, and eighth lunations.

b. Array D: Complete final report specifying experiment thermal performance at Descartes; finish Array D thermal design data book.

c. Array E:

1. C/S - Continue to update thermal performance predictions; review qual T/V test procedure, drawings, test setup, etc.

2. LEAM - Perform IR calibration test; update qual T/V predictions, supply qual test setup inputs.

3. LSPE - Release final DVT T/V report; update qual test predictions.

4. LSG - Evaluate ADL insulation edge modification; update qual test predictions; support ADL acceptance testing.

5. LMS - Complete qual test predictions and final DVT T/V report.

5.5 ENGINEERING LIAISON

5.5.1 Array D

a. The trainer ASE pallet modification was completed 3/2/72 and stowed for the acceptance test. The test was conducted by Crew Engineering with the NASA Resident Representative present, and was successfully completed. The ASE Pallet together with Tool Carrier were hand-carried to KSC 3/2/72.

b. Array D Flight Delta CF^2 - The flight and back-up crew members were at Hanger "S" 3/3 for the review of the latest design changes to the flight hardware. The design changes reviewed were the ASE Pallet stiffening, the HFE thermal modification, the Tool Carrier Mod for the Carry Bar, the new ALSD drill stems, and the soil sampler experiments. All hardware functioned well and was accepted.

5.5.2 Array E

a. The post acceptance vibration functionals have been performed on aiming mechanism and shorting plug with no anomalies encountered.

b. Qual S/P II final assy stowage and log book review was completed 3/3/72 in readiness for Mass Properties.

The mass properties and acceptance level vibration were completed 3/8/72. The bumble & boydbolt verification of S/P II was completed, 3/10/72.

The addition of the UHT dust cover has now been completed (3/14/72).

Preliminary stowage of S/P II Qual is being performed in preparation for QTRR. All modifications have been performed with the exception of the propose changes to the present aimi ng mech & the removal of the carry bar handles.

c. Qual S/P I - With the completion of the EEM LSG update all mechanical hardware is complete and ready for stowage when the C/S becomes available, from verification testing.

The schedule for S/P I Qual stowage to the deployed configuration is due to start on April 3 with completion on April 10. Stowage for acceptance vibration is scheduled to start April 10 and be stowed by April 12.

d. Flight S/P II - All mechanical hardware is complete with the exception of the shorting plug. The flight S/P II mechanical stowage for acceptance testing is scheduled to start May 8 with completion May 19.

e. Flight S/P I - Flight S/P I with the completion of the LMS inserts 3/1/72, all mechanical hardware is available for final mechanical stowage of S/P I (scheduled completion following availability of the C/S is by 5/25/72) Stowage to deployed configuration for acceptance testing is scheduled to start April 13 with completion April 16.

The three open action items on Flight S/P I primary structure: two CRN incorporations, the lengthening of thermistor leads and the addition of the new curtain clips; and one DR rework to replace a discrepant thermistor, were completed on 3/30/72.

f. Flight Shorting Plug - A DR was obtained against the switch ball plunger during the post foaming functional test 3/2/72 and has been reworked. During final inspection a DL was generated against the lacing of the harness because the laced bundle was higher than the housing. The lacing has been reworked, the functional test run, and paint touch-up performed. The shorting plug assy was finally completed March 15 and placed in bonded stores.

g. The Qual Shorting Plug assembly will be repainted as soon as it is released from the C/S verification. The plan is to have the units completed by April 4.

h. Flight Astronaut Switch rework and installation assy into Central Station was completed on 3/3/72.

i. The sign-off and release of this Array E (S/P I & II) fit-check procedure was completed 2/28/72.

As a result of the S/P II QTRR and additional comments, a CRN was generated on the Fit Check Procedure to include the new requirements. These were incorporated 3/16/72.

2nd

5.5.3 Array E LSPE Timers

a. The investigation of the problems surrounding the mechanical timers for the LSPE Explosive Packages continued this week with an indepth review of the facilities at BWC, further review of the drawings, a complete review of the DR's, FIAR's, cause, and corrective actions, the overall Quality Plan, and proposed design changes.

b. A status report was submitted 3/24 with direction to continue the review and prepare a plan for presentation to MSC on 3/29 & 30.

5.5.4 Array E LSPE Training Model

a. Two explosive packages from the LSPE Training model were returned for failure analysis of the receiving antennas. A preliminary review of the problems was made by Experiments Engineering but further evaluation is being performed.

J. L. McNaughton

Approved by:

R. E. Kovac
ALSEP Engineering Manager

JLM:bjs

Internal
Memorandum

Bendix Aerospace Systems Division

Date April 17, 1972 Letter No. 9713-551 Ann Arbor, Michigan

To T. Fenske

From D. Fithian

Subject Monthly Report for Design Integration - March 1972

6.0 SYSTEMS ENGINEERING AND TEST SUPPORT

6.1 Array D

Engineering effort involved preparation of material and reviews of Mission Rules for Apollo 16 mission.

Major effort is to be performed during April to support the actual mission.

6.2 Array E

6.2.1 Accomplishments

6.2.1.1 Qual Model

Engineering support was provided during conduct of the following tests:

LSP Integration
C/S EMI with LSP
LMS Integration
System IST (less LSG)

Minor problems occurring during these tests were resolved and closed out without hardware impact. One discrepancy was noted during C/S-LSP Integration that required a design change. The experiment status lines going to the LSP 16 channel multiplexer exhibited improper readings during LSP mode. It was determined that those lines were particularly noisy and that addition of filter capacitors eliminated the problem. Four Filters were added on the existing harness terminal board and wiring was rerouted accordingly. Subsequent testing verified that this solution was satisfactory.

Following completion of the above series of tests, the central station was returned to manufacturing for replacement of pre-qual configured components with full qual status components and completion of the central station.

The Qual S/P 2 QTRR was completed the first week in March. All mechanical acceptance tests were successfully completed during the month. It was decided that LEAM would not be included during this series of tests on S/P 2 because of schedule problems with LEAM. The test series included S/P 2 stowed with a simulator for LEAM, HFE and the RTG; acceptance vibration, tumble and Boydbolt verification were completed.

6.2.1.2 Flight Model

The flight central station was completed in assembly on 3-7 and the first functional test successfully completed on 3-8. Subsequent tests were expedited on a seven-day 24-hour/day basis to improve schedule.

LMS EIT was completed 3-9
C/V Verification and Calibration 3-13
HFE Integration 3-18
LSP Integration 3-21

Only 2 DR's of significance were generated during this series: HFE exhibited an intermittent data error in the probe cases thermocouple readings. Troubleshooting is to be performed with the Experiment Test Set to isolate this fault. DR 4867 was written to document intermittent operation of the bottom structure thermistor. Troubleshooting isolated the fault to this element and the DR was dispositioned for rework-replacement of the thermistor.

The EMI test (Central Station with LSPE) was completed by 3-23 with a DR against radiated interference at three frequencies, one of which was downlink. Since radiated limits apply only to the system level when flat cables are all in place, the disposition was held until completion of System EMI.

The flight C/S was returned to manufacturing for thermistor rework on 3/24.

6.2.1.3 System Analysis

System EMI tests were performed on the DVM Central Station and proto or engineering model experiments. This test was performed to provide early confidence of system EMI compatibility. No major problems were noted during this engineering test. Memo 9713-533 documents the results.

Analysis and testing of design changes required to prevent scrambled relays at initial turn-on was completed. ATM-1087 documents the study and explains the mechanism and fix.

An additional mini-technical review was supported at MSC in early March. This meeting reviewed the total central station status including hardware as well as recent design changes.

ATM-1093 was written, giving the Bendix rationale for not repeating the MSFN compatibility tests. The differences between the Flight model and the DVT model tested at MSC could not affect the results of the test. However, if MSC insists upon a repeat of the tests it is proposed that the updated DVT model be used, rather than the Qual model.

ATM-1092 on the mutual interference between ALSEP and the SEP experiment has been prepared. In general, Array E meets the requirement of AL 770000, the controlling EMI document, but to remove any possibility of mutual interference it appears that a separation of 100 meters may be required.

The results of the compatibility test of the radiating LSPE with the remainder of ALSEP were analyzed. LEAM shows a definite susceptibility, but it appears to be direct pick up into the experiment, rather than flat cable pick-up.

Work continued on the calibration programs for MSC with a consequent major revision of SE-33, the Measurements Document. The increasingly greater interest by the Support Groups has also necessitated several amendments to ATM-930, the Array E Command List.

The System Description, ATM-1072 and the Connector Function (Wire) List, are still undergoing review and updating.

Support of the Flight and Qual model tests has continued in the areas of routine power calibration analysis and anomaly analysis.

6.2.1.4 Test Procedures

1. There were five new ALSEP test procedures (Type I Documents) released and transmitted to NASA

2. There were nine new ALSEP test procedures (Type II Documents) released and transmitted to NASA

3. There were eight ALSEP test procedures (Type I Documents) revised by CRN/ECN action and transmitted to NASA

4. There were seven ALSEP test procedures (Type II Documents) revised by CRN/ECN action and transmitted to NASA

5. Notice has been received that 13 ALSEP test procedures (Type I Documents) have been reviewed and approved by NASA.

6.2.1.5 System Test Set Maintenance and Software

Maintenance of Programmer Processor equipment was required on almost a continuous basis throughout the month. Return of S/N 1 STS was completed following loading of ALSEP Flight 5. Availability of this unit will help alleviate the bind which may be expected during parallel qual/flight testing.

Update of LSPE software was required following LSP EIT testing. It was noted that an apparent "glitch" in geophone data existed in analog recordings of decompressed data. Investigation showed a bad software point in the program which was attributed to a fault in tape-to-card conversion.

6.2.1.6 System Power Summary

The current System Power Summary is shown in Table 6-1.

TABLE 6-1

ARRAY E POWER SUMMARY

1. Data Subsystem	Day (watts)	Night (watts)
Receiver	0.90	0.90
Command Decoder	0.65	0.65
Data Processor	2.30	2.30
Transmitter (Teledyne)	9.00	9.00
Diplexer Switch	0.10	0.10
Harness Losses	0.30	0.35
PDU Losses	1.75	2.50
TOTALS	15.00	15.80

2. System	Day (watts)	Night (watts)
Data Subsystem	15.00	15.80
LSG	2.75	8.75
LMS	10.21 *	11.2*+
LEAM	3.16	6.6
HFE	3.90	10.70
LSPE	5.3	5.3
TOTAL PCU LOAD	40.32	58.35
PCU Losses	6.28	8.09
Minimum Reserve Power	2.00	2.00
TOTAL POWER REQUIRED	48.60	68.44
RTG Power (EOM)	72.00	72.00
Reserve Power Available	23.40	3.56

+ Includes backup heater. If performance is nominal this heater will not be used and night power will be the same as day power. In that case Total Power Required will be 67.45 watts.

* Increase .2 watt for multiple mode LMS.

6.2.2 Problems

No new problems have been identified during this period in the Central Station Hardware. Planned tasks such as preparation of system documentation have been rescheduled because of priorities assigned to analysis and resolution of component system hardware and design problems.

6.2.3 Plans for Next Month

6.2.3.1 Qual Model

a. Complete Post-Component Change-out Verification of Central Station

b. Support preliminary QTRR for S/P I

c. Complete S/P I Stow, acceptance vibration, tumble, Boyd-bolt verification and MIST LSG mass simulator to be used for acceptance testing on S/P I

d. System EMI to be completed

e. Prepare for formal QTRR in early May.

6.2.3.2 Flight Model

a. Complete integration of LEAM and LSG and perform IST

b. Change out components for final flight configuration and re-verify the Central Station.

6.2.3.3 General

a. Provide procedure support

b. Complete procedures required for test program

c. Coordinate and checkout thermal vacuum test set up prior to requirement for qual

d. Complete action items and report as required.

D. Fithian

DF:cc

NOTE: No engineering effort (other than normal mission support) has been expended on the experiments listed below during the current report period:

Suprathermal Ion Detector Experiment/Cold Cathode Gauge Experiment

Dust Detector

Solar Wind Spectrometer

Charged Particle Lunar Environment Experiment

Laser Ranging Retro-Reflector Experiment

Lunar Surface Magnetometer

Passive Seismic Experiment

Internal
Memorandum

Bendix Aerospace Systems Division

Date 10 April 1972 Letter No. 72-982-B218 Ann Arbor, Michigan

To T. Fenske

From L. R. Lewis

Subject LSPE Monthly Report for March 1972

1.0 ACCOMPLISHMENTS

Prototype

1. Completed design limit vibration and shock on eight (8) explosive packages. No significant problems were encountered during vibration and shock tests.

2. Shipped two explosive packages (EP SN-9 and SN-10) to WSTF for field tests. Two others had previously been shipped on about 15 February (EP SN-2 and SN-5).

3. A third explosive package (EP SN-7) was shipped to WSTF after problems were encountered during timer time-outs at WSTF.

4. Four explosive packages, EP's 5, 7, 9 and 10, were deployed on 23 March and EP's 5 and 9 successfully detonated on 27 March 1972. Examination of EP's 7 and 10 showed both were in resafe position and could be recovered. Packages were disassembled and E&SA's returned to BxA for failure analysis.

5. EP SN-3 was modified for dust protection changes and dust test performed. Battery timer stopped during test. Timer was trouble-shot and returned to Bulova. Timer stoppage was not related to dust aspects of test.

6. Electrical schematics were completed for dome instrumentation.

Qualification Model

1. Central Electronics completed all subsystem level tests including PIA and operating vibration.

2. Geophone module completed all subsystem level tests.

3. Central Electronics, Geophone Module, and Transmitting Antenna were integrated with central station and successfully completed EIT, central station EMI, and IST. No significant problems were encountered.

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4. All Explosive Package Baseplate Assemblies were completed to the extent that timers were available for installation. Nine battery and five slide timers were installed. Timer time-out tests were completed on three (3) explosive packages prior to the end of this report period.

Flight Model

1. Central Electronics completed all subsystem level tests including PIA and operating vibration.

2. Geophone Module completed all subsystem level tests.

3. Central Electronics, Geophone Module and Transmitting Antenna were integrated with Central Station and successfully completed EIT and Central Station EMI.

4. Explosive Package Baseplate Assemblies were completed through the point of timer installation.

2.0 PROBLEM AREAS

Timers - All Models

1. Timer problems were encountered with five out of eight prototype explosive packages during timer time-outs either before or after vibration and shock tests. Limited troubleshooting was performed at BxA and timers returned to Bulova for more detailed troubleshooting.

2. During prototype timer time-out at WSTF, anomalies were encountered with a slide timer on EP-5 and a battery timer on EP-2. The battery timer stopped during time out cycle and slide timer arm function was one-half hour late although resafe function occurred at nominal time. EP-2 was returned to BxA for troubleshooting and decision was made to deploy EP-5 since slide timer anomaly would not affect function of package.

3. Timer problems were also encountered with qualification model timers being tested at Bulova and BxA. Problems included failure to start, excessive crown depression forces, "sticking" of drum, assembly errors, and improper initial setting of timers.

As indicated, a large number of timer problems were encountered recently as contrasted to the good performance of timers in mid-December to mid-February time period. Particularly significant were failures in EP-2 and EP-5 at WSTF which had successfully passed five timer time-outs previously. Their failure on the sixth time out was indicative that simply obtaining repeated successful time outs was not sufficient to screen out defective timers as had previously been attempted. As a result, BxA established a team to re-evaluate

the timer and recommend additional actions to resolve the problems encountered. The results of this evaluation were presented at MSC in a meeting on 29 and 30 March 1972. The team evaluation was that the basic design of the timer was simple and should work reliably: however, many small faults exist in the design which combined removed all the performance margin from the timer. That is, any small assembly problem would result in a failure of the timer to operate. The team recommended a number of changes designed to improve the margin such that timer would not be supercritical to minor assembly anomalies. As a result of the plan presented all prototype, qual and flight timers will be reworked

Antennas - Trainer, Qual and Flight

During trainer deployment in early March, Jack Schmidt pulled apart the first receiving antenna he attempted to deploy and then successfully deployed the remaining seven antennas. Bendix initiated a 15 pound pull force test on remaining trainer antennas and a second antenna pulled apart at a force of 12 pounds. Examination of these antennas at BxA revealed two faults; on the first antenna the distance between the wiper slot and the end of the tube was less than the .060 minimum recommended from a stress analysis. On the second trainer antenna that pulled apart it was determined that the difference between the OD and ID of tubes that separated was such that less than one mil interference existed between wiper and swagged section of tube below. Thus, under pull force the wiper deformed sufficiently to pull through the swagged section. An evaluation indicated that properly fabricated and assembled antennas can withstand the anticipated mission pull forces of up to 15 pounds. However, it was also judged that the present acceptance pull force test of 15 pounds was not severe enough to detect a marginally assembled antenna. The plan developed to resolve the problem involves a detailed inspection of antennas to detect marginal slot to end to tube dimensions or marginal ID to OD difference conditions. Tubes not satisfying new inspection requirements will be reworked. Inspected and reassembled antennas will be subject to an acceptance test of 20 pounds on last four sections. Two qual model receiving antennas will be selected and subject to a qualification level test of 25 pounds.

Geophone Coil

Troubleshooting on the prototype geophone failure which occurred during initial field tests revealed that problem was caused by a weak mass lock button spring clip on the prototype unit. Geotech specified that a minimum force of 1.7 pounds should be exerted on mass lock button. Qualification and Flight model spring clips exert forces of 8 to 12 pounds while prototype clips exerted forces of only 1.2 to 1.8 pounds. The weak spring on the prototype could allow the coil to move and be damaged during induced environments testing.

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Transport Frames

Difficulty was encountered in fabricating and plating several of the small magnesium angles used in the frame structure. The angles tended to develop cracks which were not observable until after magneisum was exposed to the high temperature plating baths during the tin reflow process. Problem was greatly reduced by zyglowing parts after fabrication to detect any defects prior to plating.

Silicon Control Rectifiers in Explosive Packages

At the end of the report period BxA was informed that a silicon controlled rectifier made by Solid State Devices Corporation used in the explosive package firing circuit failed its type C tests. Bendix has an acceptable exact replacement in stores which has passed all B and C tests. Bendix is preparing paper work to changeout SCR's and retest units.

3.0 PLANS FOR NEXT REPORT PERIOD

1. Implement antenna inspections, rework, and retest units.
2. Complete qual transport frames.
3. Replace SCR's in all qual and flight model explosive packages and retest qual models prior to the end of April.
4. Return all prototype and qual model timers to Bulova for rework.
5. Complete assembly of first modified engineering model timers at Bulova.

L. R. Lewis, Manager
Lunar Seismic Profiling Experiment

LRL/elg

Internal
Memorandum

Bendix Aerospace Systems Division

Ann Arbor Michigan

Date 4 April 1972 Letter No LEAM-190

To T. Fenske

cc: O. Berg
LEAM personnel

From D. Perkins

Subject LEAM Experiment Monthly Progress Report for March 1972

8.0 LEAM

8.1 Accomplishments

A. The collector board for the Qual unit was repaired and installed in the experiment. The unit was tested, the assembly completed and the experiment delivered to the system.

B. The integrated system test for the Qual ALSEP system was completed successfully. Data obtained during the test indicated that the live squibs used to release the dust covers were not wired correctly. (Dummy squibs are used for all tests.) A drawing change was made and the squibs were rewired.

C. The assembly of the Flight electronics using the new multilayer board (2347001) was completed. Testing of the unit indicated that the multilayer board was incorrectly manufactured.

D. Evaluation of the error in the multilayer board was conducted at Bendix and Vostron. Corrective action measures were agreed and instituted to ensure that future boards will be assembled correctly.

E. The original multilayer board, assembled by Time Zero, was re-installed into the Flight experiment and testing started.

F. All available parts for the new multilayer board have been kitted.

8.2 Plans for April

A. The Flight model assembly and test will be completed and the unit delivered to the system at the end of the month.

B. The master drilling drawing and drill template drawing will be reviewed and released for the new multilayer boards.

C. The Amelco and Texas Instruments components will be in final test phase by the end of the month.

8.3 Problem Areas during March

A. The first LEAM multilayer board, built by Vostron for Bendix was manufactured incorrectly. Corrective actions are being taken to ensure correct assembly of the next board.

B. The Qual model squib circuits were incorrectly wired. A design change has been instituted to correct both Qual and Flight assemblies.

D. Perkins

Approved:

K. Hsi

DPgmw

Internal
Memorandum

Bendix Aerospace Systems Division

Ann Arbor Michigan

Date 7 April 1972 Letter No. LMS-689

To T. Fenske

cc: J. Sanders
J. Fava J. Hoffman
D. Cook K. Hsi
C. Kern
T. Laymon
J. Riley

From L. C. Duesterberg

Subject LMS Monthly Progress Review Report - March 1972

This report describes the major accomplishments on LMS during March including technical problems encountered and their solutions. It also includes work to be accomplished in April.

1. Accomplishments

A. Completed the following activities on the LMS Qual unit.

(1) Final Assembly
(2) PIA Test
(3) Mass Properties Test
(4) Experiment Integration with Central Station
(5) Integrated Systems Test with ALSEP

B. Completed hot/cold/ambient test and EIT with the system on the LMS flight electronics assembly. Disassembled flight electronics and sent analyzer and associated electronics to UTD for multi-energy mode modifications.

C. At UTD, completed the following:

(1) CDR on multi-energy mode modification
(2) Design and documentation on multi-energy mode modification
(3) Assembly and test of the flight emission control PCB and assembly of the Qual emission control PCB incorporating the new change. However, both of these boards were found to have the problem discussed in problem 3A below.
(4) Assembly of new flight emission control PCB correcting the problem described in 3A.
(5) Pump down and gain check on flight analyzer multiplier tubes. Results of gain measurement were as follows:

Mass Range	EM Tube SN	Gain	EM Voltage March '72	EM Voltage December '71
Low	556	1×10^7	2120	2120
		2×10^7	2250	2250
Mid	561	1×10^7	2300	2160
		2×10^7	2420	2280
High	547	1×10^7	2140	2260
		2×10^7	2260	2380

Dr. Hoffman indicates this is encouraging in that only one of the three tubes showed any degradation and it was small (maybe within the accuracy of measurement).

D. Completed disassembly of LMS Prototype and shipped analyzer and associated electronics to UTD for incorporation of multi-energy mode change.

2. Plans for Next Month

A. At UTD complete the following:

(1) Test on the new emission control PCB for flight and Prototype units.
(2) Integrate electronics with analyzer and complete integration and acceptance tests on flight and prototype hardware. Ship both units to Bendix.

B. Complete assembly of LMS flight electronics assembly with new multi-energy mode and conduct hot/cold/ambient and operating vibration tests on the unit.

C. Receive UTD prototype hardware with new emission control PCB (Qual unit) and complete incoming inspection and test and start assembly of Prototype electronics unit.

D. Complete Vacuum test on Analyzer Simulator.

3. Problems

A. After UTD had assembled and tested the new Flight and Qual (Proto) emission control PCB's they discovered that the high voltage track in the PCB came too close to the standoffs (grounded) thus presenting a possible arcing problem. After reviewing several alternate solutions, it was agreed that the PCB layout should be modified and new PCB's be built and assembled.

A. (Cont.)

To do this however, required removal of some critical parts off of the already built boards because there were insufficient spares to build new PCB's. UTD prepared a plan for removing the parts and Bendix approved it. All parts were successfully removed except the Babcock relays. Of the 12 removed parts, 3 failed leak test after removal and one failed coil resistance. Because of these failures, the reliability of the remaining removed relays was in question. Bendix had 20 Babcock relays, 2338517-1, which had been purchased for earlier ALSEP array. These relays were tested at STL in Dallas and were then used to build up the new PCB's.

B. During Mass Props test, the Qual unit weighed 20.09 lbs. which is .09 lbs. over the weight specified in LMS Performance Specification AL900132 but is well within the contract weight of 22 lbs. The flight unit is expected to weigh about 20.12 lbs. as a result of the multi-energy mode change. A specification change notice #3 has been sent to NASA to increase the allowable weight in AL900132 to 20.12 lbs.

L. C. Duesterberg

Approved:

K. Hsi

LCD/gmw

Internal
Memorandum

Bendix Aerospace Systems Division

Ann Arbor, Michigan

Date 6 April 1972 Letter No. 984-653

To T. Fenske

cc: A. Carraway
Dr. J. Weber
R. Wallace

From B.A. Pilon

Subject LSG Monthly Progress Report for March 1972

Accomplishments

1. Considerable progress was made on the LSG qual and flight model schedules. It is currently expected that both models will be delivered to the System for integration on schedule

2. The following effort was completedo n the flight model:

   A. Completed flight electronics package noise test, operating vibration test and post-vib functional test.

   B. Negative results were obtained from the flight electronics noise test because the U of Md recorder was not functioning. The recorder was repaired and a second noise test was completed on Sunday, 5 March.

   C. Delivered the flight electronics noise tape to the U of Md for data reduction. The test results demonstrated the electronics achieved the design goal for frequencies greater than 0.2 cpm. The peak power spectra was 13 db below the spec limit (see Figure 1).

   D. Delivered flight electronics package to ADL for final instrument assembly on 6 March.

   E. Completed flight heater box seal assembly with instrument housing and leak test at ADL.

   F. Completed assembly of the gimbal on the flight unit.

   G. Completed flight sensor package/inner container clearance test.

   H. Completed assembly of the flight unit on 27 March.

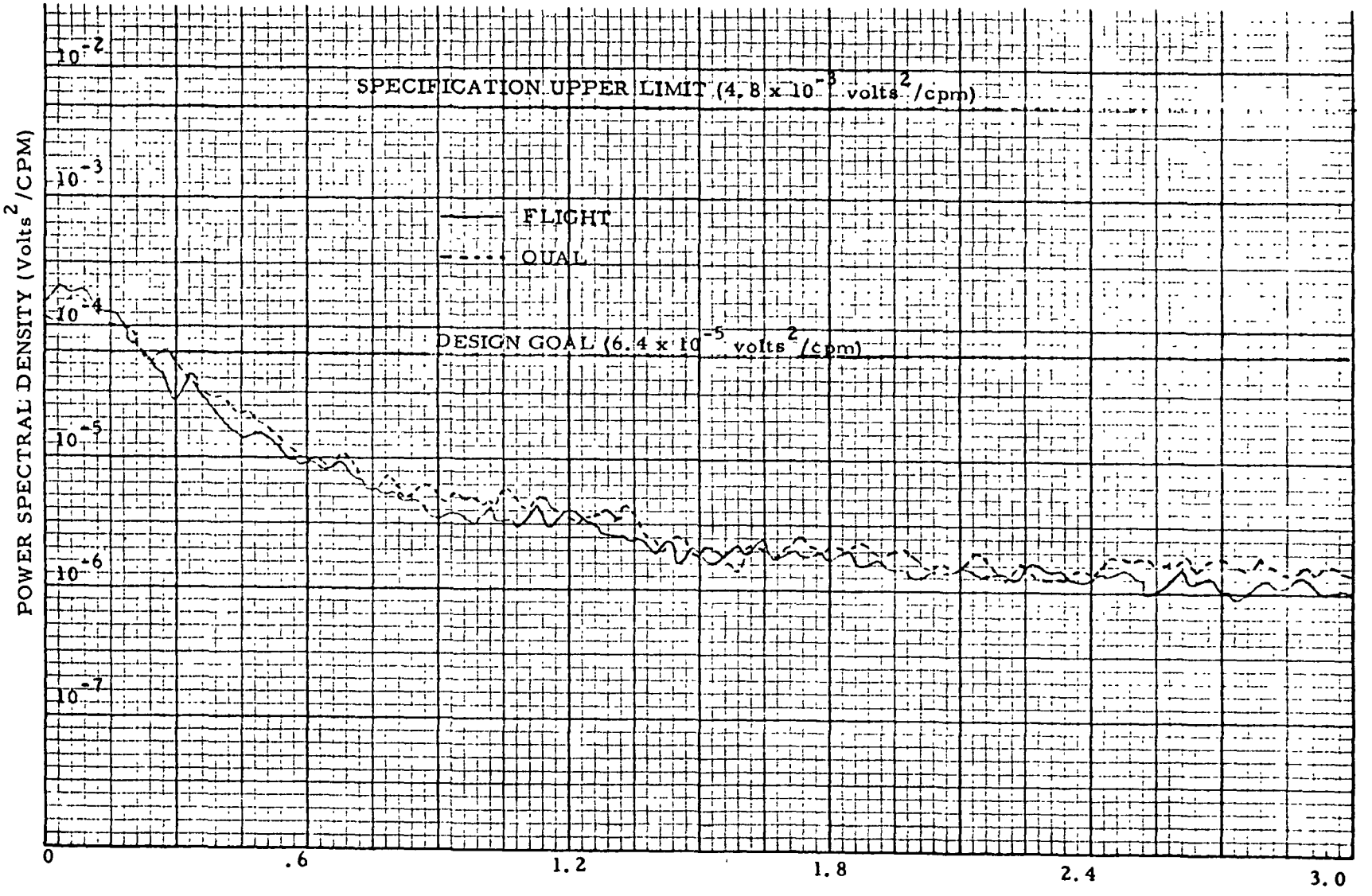

Figure 1 Power Spectrum of the Free Modes Filter Flight and Qual Electronics Package

I. Completed operational acceptance test and nighttime thermal and vacuum test. The results indicate proper thermal control with a maximum power requirement well within spec, 7.5 watts versus spec of 9.2 watts.

3. The following effort was completed on the qual model:

A. Completed qual electronics package acceptance functional test.

B. Completed qual electronics package acceptance level and design vibration tests.

C. Completed the qual electronics post vibration functional test.

D. Completed qual electronics package noise test with similar results as flight (see Figure 1).

E. Qual electronics package was delivered to ADL on 15 March.

F. Completed integration of the sensor package and electronics package.

G. Delivered qual heater box assembly to ADL on 3 March.

H. Completed leak test of the qual model sensor package.

I. Started assembly of the gimbal mechanism.

4. After the qual electronics package design limit vibration test, three anomalies were noted.

A visit was made to MSC to review the qual electronics anomalies. It was agreed that the original two anomalies were most likely due to EMI thru the test set-up and that the third anomaly is caused by a short of an unscreened 54L95 at low temperature (non operating temperature). It was agreed by MSC and Bendix management that the 54L discrepancy is to be dispositioned to use-as-is.

5. A visit was made to ADL and plans for the FACI were completed.

6. The thermal shrouds for use during LSG PIA testing and during system and T/V open door testing were checked out and modified.

7. The magnetic protection plan has been initiated.

Plans for Next Month

1. The following items are scheduled for completion on the flight model:

   A. Final operational acceptance test at ADL.

   B. FACI at ADL prior to delivery of the flight model.

   C. Performance of mass props and PIA tests.

   D. Delivery of LSG to ALSEP System for acceptance tests.

2. The following is scheduled for completion on the qual model:

   A. Final assembly at ADL.

   B. Acceptance testing at ADL.

   C. Performance of mass props and PIA tests.

   D. Delivery of LSG to ALSEP System for qualification tests.

3. Support of the preliminary QTRR, QTRR and FTRR.

4. Support of System tests.

Problem Areas

1. Qual model electronics problem noted above.

2. No current outstanding problems.

B.A. Pilon

Approved by: K. Hsi

Internal
Memorandum

Bendix Aerospace Systems Division

Ann Arbor, Michigan

Date 10 April 1972 Letter No. 978-13-593

To T. W. Fenske cc: J. Sanders

From B. D. Smith

Subject HFE Progress Report for March

7.0 HEAT FLOW EXPERIMENT

7.1 Accomplishments

A. Array E Flight EIT started 3/15. During the test, HFE SN7 probe 2 thermocouple channel outputs were intermittently out of tolerance. The printed decimal data indicated that the HFE data amplifier output was saturated positively at times during these measurements. DR AC4503 records the troubleshooting performed. The results clearly showed the malfunction to be temperature dependent. The HFE instrument was operating in a vacuum during the test. The EIT test was completed and the instrument was disconnected from the Central Station 3/16/72.

Troubleshooting continued on DR AC4504 with temperature cycling of the electronics package in an environmental chamber. Saturated data appeared initially but the fault symptoms disappeared shortly after turn-on. The unit was then installed in the HFE Thermal Simulator and allowed to cool and warm in a vacuum for a considerable time but no faulty data appeared.

The electronics was dismantled to give access to the boards for local stressing of potentially defective locations. The saturated data condition was reinduced for a few minutes three times late 3/30/72.

B. The Array D borestems, probes fit-check was satisfactorily performed twice, once with new 54" long borestems and the instrument was packaged for flight.

C. A suited deployment of the ALSEP Array D trainer by C. Duke was witnessed.

D. An HFE demonstation probe was loaned to the HFE P.I. for mission contingency evaluation. Some important contingencies were established for emplacing probes in the event of drill borestem breakdown or separation.

E. Polyruethane cast probe packing pieces were delivered for trainer use.

F. Array E Qual IST was satisfactorily performed.

G. HFE SN2 refurbishing for System Qualification testing was virtually completed.

7.2 Plans for Next Month

A. Find the cause of HFE SN 7 faulty data and repair the instrument.

B. Support the Apollo 16 mission.

C. Continue with data reduction.

B. D. Smith

Approved.

K. Hsi

BDS/gmw

Internal
Memorandum

Bendix Aerospace Systems Division

Ann Arbor, Michigan

Date 4 April 1972 Letter No. 978-12-1244

To T. Fenske

From J. McDowell

Subject ASE Monthly Progress Report

12.0 ACTIVE SEISMIC EXPERIMENT

12.1 Accomplishments

A. The trainer MPA pallet stiffening modifications were completed, acceptance tested (deployed) and returned to KSC on 2 March. The modified flight pallet was deployed and accepted by the prime crew during the Δ CF^2 at KSC on 3 March.

B. The reassembly of the flight spare Thumper, which installed the S/N 003 rotary switch, was completed on 16 March and a satisfactory resistance and ordnance test verified the rework. The test results permitted the closing of the two outstanding switch failure DRs (AC 0547 and AC 3761). This completes all work on this unit.

C. Protective covers were installed on the #1 and #3 launch tubes of the S/N 20 GLA at KSC per CRDs 61014 and 61018. Subsequently, the live GLA was installed in the flight mortar box and x-rays were taken of the GLA/mortar box connector and of the SAFE-ARM switches. The x-rays verified proper mating of the connector and showed no evidence of solder balls in the switches. The loaded MPA was satisfactorily fit checked with the flight MPA pallet.

D. The existence of a pin in the conductive bar of the S/N 003 rotary selector switch, found during a failure investigation of that switch at McGraw-Edison, generated an MSC requirement to x-ray the flight Thumper. Visual examination and x-raying of four other switches at BxA have failed to identify a pin in those switches, thus substantiating the McGraw-Edison position that the pin was only installed in early switch assemblies. A disassembled switch (S/N 009) was modified at KSC by installing a brass pin (0.028" diameter) in the conductive bar in a position similar to the configuration in the S/N 003 switch. X-rays were taken to establish a reference for comparison to the planned x-rays on the flight unit. Excellent definition x-rays were taken of the flight Thumper on 14 March. A thorough evaluation of the flight x-rays, with a comparison to the modified switch negatives, resulted in an acceptance of the x-rays as showing no evidence of a pin in the S/N 011 (flight) switch and

that sufficient clearance (0.017") exists between the common blade and the conductive bar. FIAR AA-EH-00D29 has now been revised to reflect these results and was submitted to MSC on 29 March for their review and approval.

E. All flight ASE x-rays were accepted by the NASA project engineer and KSC R & QA which permitted final stowage of the ASE on the subpackage on 15 March.

F. The upper weldment of the trainer Thumper was accidentally broken into two pieces at KSC by someone walking into the end of the unit while it was firmly strapped down on a table during cable restowage. The broken parts were welded together using asbestos packing and a steel sleeve inside the weldment to protect the wire bundle from heat. All non-fired circuits (9-21) were electrically checked, using an ALINCO, on 7 March to verify no circuit damage as a result of the repair welding. The unit was taken to Patrick AFB and fired once (#9) prior to flight. In the KC-135 one additional initiator (#12) was fired and "no fires" occurred on initiators #10, 11 and 13. All circuits were again checked, back at KSC and troubleshooting isolated the misfire cause to a spread test jack on the Thumper which was intermittently breaking the power circuit. This was corrected and another initiator (#11) was fired on the ground verifying the test setup. On 10 March, initiators 13 thru 21 were successfully fired in the KC-135 by the prime crew.

G. During the firings of the trainer Thumper in the KC-135, one initiator (#10) "no fire" could not be explained by the spread test jack found on the Thumper. During the "no fire" troubleshooting this one circuit was found to be "open" although the crew indicated it had not fired. The circuit was known to be intact and with resistance measurements within specification prior to the firing attempt. This is based on the proper electrical check of all circuits made subsequent to the welding repair and prior to flight. KSC was requested to disassemble the impact plate which verified that the initiator head had not ruptured, conclusively indicating that it had not fired. On the other hand, an electrical test (using an ALINCO) made across the pins of the initiator verified that the bridgewire is an open circuit. The initiator was removed, per MSC direction, and shipped to Houston on 24 March. MSC has verified the non-fired, open circuit condition and x-rays have been taken. The x-rays are inconclusive and MSC is proceeding with extensive non-destructive testing which may take 3-4 weeks to complete before the failure cause is resolved.

It should be noted that the subject initiator is from a lot different than the lot used for all previous Thumpers including the Flight 5 unit. SOS, the supplier of the ASI, has been contacted and LAT data, serial number, lot number, BxA P.O. information has been obtained and supplied to MSC.

12.2 Plans for Next Month

A. Complete initiator failure analysis.
B. Provide Apollo 16 mission support.
C. Complete amplifier analysis at Geotech.

J. M. McDowell

Approved:
K. Hsi

JRM/gmw

Internal
Memorandum

Bendix Aerospace Systems Divisio

Date 6 April 1972 Letter No 72-977-774 Ann Arbor, Michigan

To T. W. Fenske

From R. J. Hostetler

Subject Monthly Progress Report - March 1972

1. Tests completed during this reporting period are as follows:

ARRAY E - Proto and Engineering Models

LSP Explosive Packages (set of 8) Design Limit Vibration
LSP Explosive Packages (set of 8) Shock

ARRAY E - Qualification System

LSP Central Electronics Post Vibration Functional
LSG Electronics Package Functional
Sub-Package II Mass Properties Determination
LSP Integration with Central Station
Central Station EMI
LSP Geophone Module Mass Properties Determination
LEAM PIA
LMS PIA
LSG Electronics Package Operating Vibration, Acceptance and Design Limit
LSG Electronics Package Post Vibration Functional
Sub-Package II Acceptance Level Vibration
Sub-Package II Tumble
Sub-Package II Boyd Bolt Verification
LMS Experiment Integration with Central Station
Shorting Plug Functional
Aiming Mechanism Functional
LEAM Mass Properties Determination
LSG Electronics Package Noise Test
Integrated System Test with IPU
RTG Leak Check
Command Decoder Operating Vibration, Acceptance and Design Limit
Command Decoder Post Vibration Functional

ARRAY E - Flight System

LSG Electronics Package Noise Test
LSG Electronics Package Acceptance Operating Vibration
LSG Electronics Package Post Vibration Functional

ARRAY E - Flight System con't

LMS Functional (Hot, Cold, Ambient)
LEAM In-Process Functional
Central Station Functional
LMS Experiment Integration with Central Station
LSG Electronics Package Noise Test Re-Run
Central Station Verification and Calibration
HFE Integration with Central Station
LSP Subsystem PIA
LSP Central Electronics Acceptance Operating Vibration
LSP Subsystem Post Vibration PIA
LSP Geophone Module Mass Properties Determination
LSP Experiment Integration with Central Station
Central Station EMI
LEAM Pre-Assembly Functional

R. J. Hostetler, Group Supervisor
ALSEP Systems Test

M. G. O'Mara, Manager
ALSEP Quality/Test

RJH/dh

Internal
Memorandum

Bendix Aerospace Systems Division

Date 6 April 1972 Letter No 72-977-774 Ann Arbor, Michigan

To T. W. Fenske

From L. P. Wagman

Subject Monthly Progress Report - March 1972

A. During the subject month the following milestones were accomplished:

1. ALSEP PCS Test Schedule and Facility Utilization Reports were updated and distributed on a weekly basis. Starting with the coming month the PCS reports will be discontinued and a bar chart type test facility utilization schedule will be provided on a weekly basis.

2. Inspection of all extender cables for C/S component operating vibration was completed. These cables are now available for qual and flight testing.

3. Final design and fabrication of the IPU/RTG simulator switch box were completed. The unit will be checked out during the coming month and installed in the 20' X 27' thermal vacuum chamber.

4. The design of the remaining cables required for the system thermal vacuum test was completed. Fabrication and inspection of these cables are scheduled for the first part of April.

5. Qualification and flight acceptance tests were coordinated. The specific tests conducted are described in the Test Group's Progress Report.

B. Milestones for the coming month are as follows:

1. Update and distribute a facility utilization schedule on a weekly basis.

2. Complete fabrication and inspection of remaining T/V cables.

3. Coordinate the planned Array E testing for the month of April.

M. G. O'Mara, Manager
ALSEP Quality/Test

L. P. Wagman, Group Supervisor
Array E Test Coordination

LPW/dh

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Internal
Memorandum

Bendix Aerospace Systems Division

Ann Arbor, Michigan

Date 10 April 1972 Letter No 975-2551

To T. Fenske

From B. J. Rusky

Subject ALSEP System Support March Monthly Progress Review

Apollo 15 ALSEP Mission Support

After 244 days (0.67 years) of operation on the lunar surface, the Apollo 15 ALSEP is performing normally in the environment of its ninth lunar noon. The total of three ALSEP's on the moon is 4.18 years of operation.

The downlink signal strength is steady and the power from the RTG is 73.5 watts compared to the value of 74.1 watts at initial turn-on. Approximately 7000 commands from Mission Control Center have been executed. The Central Station timer continues to produce automatic command pulses at 18-hour intervals.

The 23rd spurious command occurred in March and was corrected by ground command with no further problems.

Date	Function	Octal Command
6 March	HFE Mode 3	140

All science sensors performed acceptably as on previous lunations.

Apollo 14 ALSEP Mission Support

This ALSEP has completed 420 days (1.15 years) of operation on the lunar surface and is exposed to the environment of its fifteenth lunar noon. The downlink signal strength is steady and the power from the RTG is 71.5 watts compared to the value of 72.5 watts at initial turn-on. Approximately 5600 commands from Mission Control Center have been executed. The 18th and 19th spurious commands occurred in March and were corrected by ground command with no further problems.

Date	Function	Octal Command
6 March	PSE Standby	037
9 March	PSE Forced Level Mode	103

On 29 March, the Charged-Particle Lunar Environment Experiment (CPLEE) and the Suprathermal Ion Detector/Cold Cathode Ion Gage Experiment (SIDE/CCIG) experienced an unexpected change from operational to standby power. There was no evidence of either spurious commands or ripple-off and instrument operation had been normal. The SIDE/CCIG was commanded to operational power and functioned normally. On 30 March, the CPLEE was commanded to operational power and showed normal data for 33 minutes, at which time both the CPLEE and SIDE/CCIG again changed unexpectedly from operational to standby power. The CPLEE remains in standby and the SIDE/CCIG has been commanded back to operational power. The problem is under investigation.

Scheduled "listening mode" operations of the Active Seismic Experiment were conducted successfully on 3, 10, and 24 March. No operations were performed on 17 March because of the temperature constraint on the Mortar Package Assembly; a turn-on of the instrument would remove power from the survival heater and cause excessively low temperatures during lunar night.

Apollo 12 ALSEP Mission Support

After 863 days (2.36 years) of operation on the lunar surface, the Apollo 12 ALSEP is performing normally in the environment of its 30th lunar noon. The downlink signal strength is steady and the power from the RTG is 70.0 watts compared to the value of 74.2 watts at initial turn-on. More than 12,800 commands from Mission Control Center have been executed. The 50th spurious command occurred in March and was corrected by ground command with no further problems.

Date	Function	Octal Command
28 March	PSE Gain Change	063

Apollo 16 Mission Preparations

"Paper simulations" on Apollo 16 ALSEP deployment were held at MSC, with BxA participation by telephone, on 14 and 28 March. On 21 March, W. Tosh attended a simulation at MSC. Documentation (photographs, etc.) have been collected, and supplied to MSC as necessary, for use furing Apollo 16 ALSEP real-time support. MSC documentation (specifically, the Final Experiment Mission Rules) is being collected for real-time use by the BxA support team.

ALSEP Anomaly Report Summary

The current MSC/R&QA Open Problem List reflects seven (7) open items from prelaunch hardware testing. There are no open items from lunar operations on either the MSC/R&QA Open Problem List or the ASPO Problems and Discrepancy List.

KSC Operations/Field Support

Refer to Section 2 for the KSC Operations Summary of the Array D System Status.

The Monthly Spares SML was revised and submitted on 15 March.

An inventory of trainer spares at NASA/MSC was performed on 20-22 March. Based on the result of this inventory, an additional requirement for eight E2E trainer spares was identified and have been ordered.

Specific major spares activities included the following:

> Level A Spares - Three line items consisting of eleven pieces were delivered to KSC on GFE bonded stores.
>
> E2D and E2E Trainer Spares - Forty line items consisting of five hundred fourteen pieces were delivered to NASA.

The following represents the present status of ALSEP Level A Spares:

Array D

a. PSE Sensor (SN 3), PSE CSE (SN 8), PSE Shroud (SN 14), and the PSE Stool (SN 9) have been "bagged and tagged" as is and being held as residuals pending further direction by NASA/MSC.

b. Thumper Geophone - The reworked ASI Selector Switch was assembled in the thumper to the 2331220 configuration. The ambient functional acceptance test was performed accepted and now awaiting Q.C. final inspection. Subsequently, the hardware will remain "as is" pending further direction from NASA/MSC.

c. Since the Mortar Box (SN 9) has not been modified to flight configuration, the Mortar Box is also considered "residual" pending further direction from NASA/MSC.

d. The 16 Channel MUX has been reworked with screened 54L flatpacks but not reassembled into the ASE CSE and is currently being held "as is" pending further direction by NASA/MSC.

e. The 90 Channel MUX (SN 15) is currently the designated Level A Spare but has not completed spares testing and is currently being held "as is" pending further direction by NASA/MSC.

f. All other Level A Spares have been delivered and available to support flight activities through launch of Apollo 16 ALSEP.

Array E

a. Helical Antenna (SN 15) and Antenna Cable Assembly (SN 15) have been delivered by DD 250.

b. Antenna Aiming Mechanism was cancelled.

c. Diplexer Filter (SN 14) and Diplexer Switch (SN 14) have been delivered by DD 250.

d. Transmitter (SN 47 - Teledyne) has been delivered to BxA and is scheduled to be delivered to NASA by late May.

e. Build-up of the Command Decoder (SN 13), Data Processor/Multiplexer (SN 14), PCU (SN 13), and PDU (SN 15) is currently in process and completion is scheduled for April 1972.

Array E System Safety

Safety coverage was provided for prototype field testing of the LSP experiment to preclude any safety incidents. The testing was conducted at the NASA White Sands Test Faility. Four explosive packages were tested with two firing successfully. The two remaining packages were recovered safely in accordance with the LSP Field Test Safety Plan. Field support has been suspended until testing resumes in July.

System Safety Coverage was provided at the LSP timer review meeting hald at MSC on 29 and 30 March 1972.

The ALSEP Ground Safety Plan has been through an in-house review and comments have been incorporated in the text. The plan is currently being prepared for submittal to NASA and will be released in early April.

B. J. Rusky, Manager
ALSEP System Support

BJR/ram

Internal
Memorandum

Bendix

Date 7 April 1972 Letter No 9721-2795

To T. W. Fenske

From S. J. Ellison

Subject March 1972 Monthly Progress Report, ALSEP Reliability

1. General - 54L ALERT:

ALSEP Reliability has continued assessment of the 54L problem evaluation which was first highlighted at the November 1971 ALSEP Program Review.

The February monthly progress review reported that ten (10) particle screened 54L flatpacks were rejected during manufacturing assembly and in-process testing. Five of the ten devices failed electrically; the failure analysis results for four of the five were previously reported. The fifth device, a 54L78, serial number 158Z has been analyzed. There was loose metalization, several particles, and a scratched die surface.

In March, 50 additional 54L04 flatpacks were subjected to the North American Autonetics screen. All 50 passed the monitored vibration/shock test; one device failed the subsequent gross leak test.

The ATM-1081 "54L Summary" prepared in January for the ALSEP Program Review at MSC in February, has been updated to Rev. A to reflect the distribution of screened 54L devices in Array E hardware, additional parts screening and failure analysis results, and a comparison of different logic devices and assembly areas at TI-Dallas. These changes have been incorporated in Revision A, dated 30 March 1972.

Bendix Reliability and Quality Assurance visited TI-Dallas on 6 March 1972 to review lot screening data for three types of 54L series integrated circuits which were recently procured for use in Array E hardware. This review indicated that the results were consistent with lots previously procured having Bendix and GSI pre-cap. These devices have been subjected to the NAA screening and the results reported above.

2. Array E Experiments

2.1 LSP Experiment

a) Explosive Packages - The lot acceptance failure of Silicon Controlled Rectifiers (SCR's) tested by Solid State Devices Inc. (SSDI) preclude usage of these parts in the LSPE Explosive Packages firing circuits. These part numbers are designated 2340388-1. Request for Deviation/Waiver DA 0006 approved by MSC requires Bendix to use 2340388-2 SCR from GE. All qual and flight assemblies (2348359 RC 2) are being reworked using 2340388-2 SCR's from GE. (BxA bonded stores has a qty. of 50 of 2340388-2 SCR's from GE in stock).

It has been agreed that these firing circuits will be functionally retested at hot, cold, and ambient temperatures.

b) LSPE Field Tests - Two of the latest four explosive package detonations at WSTF failed during this reporting period. Serial number designations for these two packages are SN 7 and SN 10. Both explosive packages were returned to BxA for further troubleshooting. The failure on SN 7 has been isolated to a defective thermal battery timer. This timer is being returned to Bulova for further troubleshooting and analysis. The failure cause of Explosive Package SN 10 has not as yet been determined. A troubleshooting plan has been prepared in conjunction with engineering to systematically isolate the cause of failure. The cause of failure of SN 10 and corrective action taken will be reported during the next reporting period.

c) LSPE Antenna Problem - During crew deployment exercises of a qual/flight configuration antenna, the antenna pulled apart at the bottom three sections. At the MSC/BxA review meeting the cause of failure was defined as follows: The clearance requirement between OD and ID of interfacing tubes is .003 inch max. (.008 inch clearance existed). The corrective action for all qual/flight and trainer units was agreed to as follows:

(1) Measure edge distance and length of wiper slot on lower three sections.

(2) Measure clearance between OI and ID of interfacing tubes (.003 max.).

(3) Inspect wiper tabs for green discoloration.

(4) Rework all discrepant antenna sections.

(5) Test all lower sections of antenna assemblies to 20 lbs. force.

(6) Perform special tests on two qual model antennas as follows:

(a) Randomly select two qual antennas for test.

(b) Fully deploy antenna 10 times.

(c) Subject lower four sections to a 25 lb. tension load.

(d) Fully deploy antennas 20 times.

(e) Inspect wiper slot and tab for signs of yield or stress.

d) LSPE Timers - At the BxA/MSC program review meeting held at MSC on 8 March 1972, an agenda was generated outlining specific timer problems to be evaluated during a later meeting held at MSC on 28 March 1972. A problem review meeting was held at BWC between BWC/BxA on 16 March to discuss the latest timer problems which were known to exist at that time. These problems and some corrective recommendations were defined as follows:

(1) O-ring extrusion into stem cavity area which caused stem binding.

(2) Arming/safing pins change from aluminum to 416 stainless steel (aluminum too soft and causing retraction problems).

(3) Changing +24 volt microswitches to bifurcated contact switches (in addition to redundancy of switches reported last month).

(4) Methods for obtaining uniform clutch engagement.

(5) Methods of alleviating aluminum thread stripping in auxilliary mainspring barrel bridge.

An independent BxA design evaluation team was directed to review the ALSEP timer design, reliability, and quality on 14 March 1972. As a result of this review, BxA presented a firm plan to MSC for improving the reliability of the timers on 3/29 - 3/30. The results of this meeting are documented in 72-982-B211 (Minutes of BxA/MSC Meeting). As a result of this meeting 6 timers have now been downgraded to engineering model status. The present plan calls for modifying the first two timers to the minimum required engineering changes. The last four timers will be modified to the maximum required engineering changes or defined at the MSC/BxA review meeting. These six modified timers will provide the test confidence that the proto/qual/flight timers will run out properly because of the added design safety margins. The BxA design evaluation team is presently reviewing the required engineering drawing changes with BWC personnel. The first two IMPROVED DESIGN engineering model timers are scheduled for delivery to BxA on 8 May 1972.

2.2 LEAM Experiment

a) Waivers - Approval by NASA/MSC of waivers 0017 (opens on MLB's 006 and 007) has been accomplished. Deviation 0013 verbally has been approved, still waiting for official documentation.

b) Film Amplifier Failure - A poor solder connection of the module to the board is the probable cause of the initial failure. The module has been received at BxA. BxA is planning to perform electrical continuity check and then electrically test the module with power applied to it.

c) DR AC 4493 - Harris Op-Amp - During pre-integration acceptance test at BxA (in process test) conducted on the LEAM Qual Model P/N 2347700 S/N 2, it was noted that word 7 on data printout was wrong. Collectors 1, 2 & 4 were inoperative because collector 3 (word 7) was staying on (TP 2365512, para. 6.5.7). BxA Reliability/Engineering isolated the problem to a faulty module on the collector board (P/N 10122008-101). Further analysis at Time Zero located the problem to an Harris op-amp (Z1) in the suspect module.

Further analysis of the op amp is to be conducted at the manufacturer's facility (Harris, Florida). This is the first noted failure of this part (i.e. no failure trend is noted for Harris part).

FIAR-AA-EH-00E13 was issued against this failure.

d) A LEAM experiment failure history was prepared (Ref. letter 9721-2774) for Pre-QTRR meeting to be held at BxA on 4/10 and 4/11.

e) The LEAM failure reporting flow chart was issued (Ref. BxA letter 9721-2699, Rev. A). The failure reporting is based on the qual and flight test program required.

f) MLB (18 Layer) - A brief resume of the history of the procurement of the MLB is as follows: The board was built to Bendix drawings 2347001 and spec. 2349499 and Time Zero specification 10122008 DS, Rev. C. Vostron was to use the original drill template, used to build this board for Time Zero, which was throught to be in Vostron's possession. The understanding was that the continuity check would be performed to the artmaster overlays, not to a string list, which had not been updated. Using the artmaster overlays is still considered to be the best method of checking continuity.

When this board was checked it was not fully understood that the two sublaminates were connected at points within the flat-pack area.

Vostron indicated that they were confident that the Bendix boards were made using the same process and drill template as used on the Time Zero boards. Later, investigation indicated that a different drill template was used.

Continuity was checked on the Bendix boards using each artwork layer as an overlay. This method evidently only checked each sublaminate half of the board without checking feedthroughs. To check feedthroughs the feedthru points would have to be identified in advance on the overlays.

Further evaluation showed that Voston designed the board, for Time Zero, from schematics and specs. This design included a drawing 20067 which indicated the hole size and drilling sequence, which enables a drill template to be produced. No up-to-date drawing is available. The original and/or revisions may have been given to Time Zero. (Time Zero denies having them.) The drawings available indicate that 38 feedthroughs do go through in the flat-pack area.

The drill template used for the Bendix board appears to be a new one made from the Rev. B artwork and probably layer 8. It is obvious by looking at the new template that the 38 feedthroughs are drilled at the sublain level instead of the final assembly level.

The corrective action is to prepare and updated version of 20067 drawing which details the hole size and drilling and plating sequence. Additionally a drawing and number control of the drill template is required. These two drawings must be under Bendix control with Bendix assigned numbers. Close configuration control must be maintained during build and test to ensure that the latest revision drawings and specs are being used. A test procedure must be prepared for performing continuity checks to verify that all required tests have been performed. This could take the form of a check off list for each layer of overlay, feedthru check,

power and ground plane isolation, etc.

Vostron and Bendix agreed that Vostron is probably best equipped to prepare the required drawings in an expeditious manner. Bendix will review and approve these.

2.3 LSG Experiment

a) DR AC 4158 has been written against the Flight Heater Box Assy. As result of this DR the fine counter slot width and clearance of the hold diameter was increased.

Slot from .067 $\pm$ .001 to .087 $\pm$ .005

Hole from .128 - .129 to .160 $\pm$ .005

The same increments were applied to the qual model fire counter.

b) DR AC 4767 - During the leak test at ADL the leakage rate was approximately 1 x 10^{-6} scc/sec. This is two orders of magnitude greater than the maximum allowable leak rate of 1 x 10^{-8} scc/sec. The failure to satisfy the leak rate as specified in TP 2 can be attributed to operator discretion in isolating (bagging off) various sources of leakage. The leak detector was sampling leaky plumbing external to the test item as well as the test item itself. It was also sampling the open purge valve. There was no indication of component or system leak which would compromise the performance of the LSG either in storage or on the lunar surface. After resolution of the problem, the output of the leak detection sensor (H_e) was continuously recorded. Short-term peaks in the output were possibly due to outgassing from within the instrument housing. While these peaks occasionally exceeded the specified leak rate, the average rate was well within the specified limits.

c) Issued FIAR AA-EH-00E11 - Description of failure status LSG Design Limit Op Vibration on the qual electronics package. After Z axis, received command housekeeping status indicated 10101 and then 00101, it should have

remained 0010 with no change. During troubleshooting for the above failure a new problem occurred: @ less than -10°C the 2^1 bit of digital data was affected by 2^0 bit is a logic "1". Failure mode forces 2^1 bit to a logic "1". The effect in the electronics package due to this problem is a) 40 Mv error in digital data and erroneous command status, b) @ greater than -10°C electronics function properly. Normal operation is 50°C $\pm$ 5°C.

Final FIAR is expected to be issued approximately on 4/6/72.

d) Attended FACI meeting on the LSG flight model. This FACI was held on 4/4 and 4/5 at ADL - Boston. As a result of this meeting:

(1) ADL - Reliability is to issue failure reports no. 05 and 06.

Failure Report 05 (Ref. DR AC 4355) describes the trouble as "analog does not correspond to test procedure".

Failure Report 06 (Ref. DR AC 2609) describes the trouble as "no beam defection was noted when the screws were activated. Shaft encoder reading verified that the screws worked properly".

(2) In the engineering meeting the pressure histories for the qual and flight units were discussed resulting in the following summary.

(a) Summary and Conclusion

Pressure has increased slightly since sealing Flight Model Instrument Housing.

ADL's conclusion is that the results indicate outgassing.

Additional data points are desired to confirm the conclusion.

(b) Action Items - Flight Model

Obtain additional data points over the next month at Bendix during various functional tests. Voltage and temperature during both ambient and 50°C operation.

(c) Action Items - Qualification Model

ADL will obtain some points as during Flight Model program. Will include readings of thermistors for simultaneous temperatures.

BxA will obtain same data as on Flight Model.

(d) ADL to contact Metrophysics to obtain the following:

Sensitivity to output impedance.

Sensitivity to temperature over a wide range of temperature.

Sensitivity to temperature over a wide range of pressure.

Calibration of lot conformance model for above parameters.

(e) Review Engineering Model data for possible correlation.

Bendix accepted the flight unit conditionally based on the continuing measurements, (to be made at Bendix) verifying that the pressure change is due to outgassing; and the completion of the open items listed in the ADP.

e) The LSG experiment failure history (Ref. BxA 9721-2775) was issued. This report is to be presented during Pre-QTRR to be held at BxA on 4/10 and 4/11.

f) Changes to Qual vs Flight Differences (Ref. ATM 1054 - Rev. G)

(1) IC-LM 103 (5.1) (National Semiconductor) was for flight 2346273-12 and for qual 2346273-62, now qual and flight are 2346273-12.

(2) IC NH0001AH (National Semiconductor) for flight is 2346270-2 and for qual is 2346270-52.

(3) IC-LM 103 (4.3) (National Semiconductor) for flight is 2346273-10 and for qual is 2346273-60.

(4) Two minor hardware differences exist due to MRB action - a) the flight unit has a helicoil insert added to a tapped hole in the instrument housing cover; and b) the perpendicularity of a web on the inner container cover (dwg. No. 4005-02-001) on the qual unit was out-of-tolerance and used-as-is.

Details as to the differences of items 2 and 3 are listed in ATM 1054, Revision G.

2.4 LMS Experiment

a) Revision of PAA and FMECA for Multi-Mode Emission Control - ATM's 966 (PAA) and 970 (FMECA) have been updated and revised to the "B" revision. ATM 967 (Parts List) has been updated and revised to the "A" revision. These revisions are the results of the multi-mode Emission, Control circuit used on the flight model.

b) Delta CDR for Multi-Mode Emission Control - UTD held a delta CDR covering the changes to be made due to the multi-mode Emission Control circuitry. BxA Reliability was present.

c) Multi-Mode Emission Control Board Problem - After build up of the multi-mode Emission Control circuit (2 boards) for flight and qual models, it was discovered that a high voltage problem existed due to circuit "land" layout. It was decided to redesign both boards and reclaim critical parts such as the transformer and the six Babcock relays. A quality verification test was to be run by STL to

determine if the reliability of these parts had been reduced by the removal process. Of the twelve relays from both boards, three relays had hermetic seal failures indicating that during the relay removal, these seals are excessively stressed. It was decided that BxA would furnish UTD with 20 relays to replace the used relays. These relays were bought to NAA-IID specifications. Out of 20 IID relays, 2 were seal failures and one was a contact failure. All failures are being analyzed at White Sands Test Facility.

d) FIAR E-10 - With the completion of E-10 on 3/1/72, all FIAR's have been sent to MSC for closeout on LMS.

2.5 Heat Flow Experiment

a) FIAR E12 - A failure of HFE S/N 7 was reported on 3/17/72. Failure report AA-EH-00E12 was initiated. Failure was detected during EIT. Failure report fault isolation and corrective action is to be determined early in April.

3. Array E Central Station and System

a. Action Item Status

(1) AI #600 (C/S Tech Rev 2/23/72) - BxA Reliability to review 5 volt delay design fix. FIAR #E6 to provide analysis including assessment of PDU circuit changes which will prevent relays from scrambling during C/S turn on. Design mods and C/S retest to be completed by 4/10/72 and final FIAR to be issued by 4/14/72.

(2) AI #602 (C/S Tech Rev. 2/23/72) - BxA to provide part status on electronic parts needed for C/S and Experiment PC board rebuilds. Closed by BxA letter BxP. O. 5066-72-970-5440 which transmits 9721-2767 minutes of 7 March 1972 Parts Status Review Meeting held at MSC.

(3) AI #611 (C/S Tech Rev. 2/23/72) - BxA to document an assessment of SM 54L00 flatpack procurement. Closed by BxA letter BxP. O. 5069-72-970-5443 which transmits BxA Reliability analysis of SM 54L screening results.

b. Qual vs Flight Differences - The System, Central Station and Experiment Qual vs Flight hardware parts and design differences as of 3/30/72 have been reviewed and updated in Revision G of the ATM-1054 summary issued 4/4/72.

c. Array E Pre-PIA Part Failure Trends - Apart from the LSPE timers and the 54L IC's, no part failure trends have been determined to exist based on review of the Monthly Array E Scrap Report and the Monthly Discrepancy Report Computer Summaries.

d. ALERTS - By letter BxP. O. 5063(SJE)-72-970-5437 dated 14 March 1972, NASA/MSC was informed that the following ALERTS are not applicable because the items are not used on ALSEP:

(1) ALERT No. MSC-71-05A, Potentiometer, Vishay

(2) ALERT No. E4-71-01, Transistor, FET 2N3954

(3) ALERT No. MSFC-72-2, Potting Matl, ECCO-SIL-4640

(4) ALERT No. MSFC-72-3, Capacitor, Tantalum (TLW)

Additionally, seven (7) ALERTS furnished to BxA via MSC letter ED3/72/222 have been investigated. ALERTS which are not applicable because the items are not used on ALSEP include:

(5) ALERT No. KSC-72-02, Connectors, MS3126

(6) ALERT No. KSC-72-01, Switch, Coaxial

(7) ALERT No. MSFC-72-4, Connector, Microdot

(8) ALERT No. MSFC-72-5, Connector, Microdot

(9) ALERT No. MSFC-72-6, Potting Compound

(10) ALERT No. KSC-72-02A, Connector, MS3126

ALERT No. G7-72-01 dealing with one-part RTV Silicone Adhesive Sealants per MIL-A-46106A was investigated for ALSEP usage since RTV-731, RTV-140 and DC 92-024 are contained in ATM-242 "ALSEP Approved Material List". The results of investigation are scheduled for reporting via BxA letter to MSC during the next report period.

4. ALSEP Array D

a. Action Item Status - No outstanding Reliability action items.

b. ASE Thumper Switch - The spare thumper rotary switch experienced high resistance readings during PIA tests. FIAR AA-EH-00D29 was issued since this switch was previously accepted as flight hardware.

Tests showed that a gross leak existed at one area of the epoxy header. This leak was caused by voids existing between the original epoxy and the new epoxy required to reseal the switch (SN 3) during rework in August 1971. This explained how the switch could develop film contamination over such a relatively short period of time.

Vendor rework and retest of the switch was completed during the report period and a final FIAR #D29 was issued on 2/14/72, however, a collar retaining pin was observed extruding from the common ring. It was determined that the pin was an unauthorized part of the configuration and not found in other spare switch assemblies.

To insure that the Array D flight switch at KSC did not have an unauthorized metal pin in its configuration, x-rays of the thumper switch were taken 14 March at KSC. The thumper switch x-ray shows no brass pin in the conductive bar and sufficient clearance (0.017") between the conductive bar and the common wiper. All x-rays were visually checked by Bendix, the NASA project engineer and KSC R & QA, and indicate that the x-rayed hardware is acceptable for flight.

5. Composite ALSEP Failure Report Status

a. New Failure Report Items - Three (3) new failure report items were initiated during March 1972:

(1) FIAR #E11 was issued on the S/N 2 qual model LSG electronics as a result of O/T data at -10°C test conditions (normal operate range is 50 ± 5°C).

(2) FIAR #E12 was issued on the S/N 7 flight model HFE to report loss of measurements data during experiment integration test.

(3) FIAR #E13 was issued on the S/N 2 LEAM qual model because of a data anomaly traceable to a faulty operational amplifier.

Additional details of these FIAR's and current status is indicated in the open items list below.

b. Open FR/FAR/FIAR Items Status

(1) FIAR AA-EH-00D29, ASE Rotary Switch, Array D Spare

During PIA test of the SN-6 thumper, the ASI circuits indicated O/T (high) resistances in the Selector Switch. DR #AC 3761. Vendor analysis revealed voids in potting used for sealing the switch. The Array D flight switch at KSC was x-rayed on 15 March 1972 to determine that no metal pin such as found in the spare exists in the flight unit.

Status: Open

Action: (1) TWX and FR/FIAR issued 1/11/72

(2) FAR/FIAR issued 2/14/72

(3) Rev. A to FIAR issued 3/22/72

(4) BxA awaiting LSPO closeout action.

(2) FIAR AA-EH-000E4, PDU S/N-13, Array E Qual

During setup for operating vibration test, the output power on the experiment 2 operate line was zero. Troubleshooting traced the open circuit to improper seating of the mother-board to connector pins on the PDU modules. DR #AC 4156. Reassembly, retest and C/S reverification of the PDU is scheduled to be complete by 4/10/72.

Status: Open

Action: (1) TWX and FR/FIAR issued 1/28/72

(2) Final FIAR scheduled for 4/14/72.

(3) FIAR AA-EH-000E5, LSP/ASE Geophones, Flight Spare

During LSPE field test at WSTF, geophone X02 failed to operate. DR #AC 4043 and AC 4046. Vendor analysis traced the fault to a fractured geophone coil. Differences between prototype and flight configuration stowage have been evaluated to verify that the problem was peculiar to the Array E prototype.

Status: Open

Action: (1) TWX and FR/FIAR issued 1/28/72

(2) Interim FIAR issued 2/16/72

(3) Final FIAR issued 3/28/72

(4) BxA awaiting LSPO closeout action.

(4) FIAR AA-EH-000E6, Central Station S/N-10, Array E Qual

During the C/S verification and calibration test, the ADP did not switch on command; the uplink was not operating. DR AC #4168. PDU circuit changes for the 5 volt lines have been made. C/S retest of changes is scheduled to be completed by 10 April 1972.

Status: Open

Action: (1) TWX and FIAR initiated 2/4/72

(2) Final FIAR to be issued by 4/14/72.

(5) FIAR AA-EH-00E11, LSG S/N-2 Electronics, Array E Qual

After LSG design limit op vib in Z axis, HK status changed unexpectedly. Also, digital data and command status were erroneous below -10°C vs normal 50° ± 5°C operate range. Qual testing will be continued per 3/1/72 meeting agreement with LSPO.

Status: Open

Action: (1) TWX and FIAR initiated 3/13/72

(2) Final FIAR issued 3/30/72

(3) BxA awaiting LSPO closecout action.

(6) FIAR AA-EH-00E12, HFE S/N-7, Array E Flight

During HFE experiment integration test, measurements were O/T on science data. DR #AC 4504. Troubleshooting isolated the problem to a solder connection on a thermal board.

Status: Open

Action: (1) TWX and FIAR initiated 3/21/72

(2) Final FIAR scheduled for issue by 4/12/72.

(7) FIAR AA-EH-00E13, LEAM S/N-2, Array E Qual

During inprocess operational checks on the S/N-2 LEAM, word 7 data printout was wrong and collectors 1, 2 and 4 were inoperative because collector 3 (word 7) stayed on. DR #AC 4493. Problem traced to an operational complifier which is scheduled for vendor failure analysis.

Status: Open

Action: (1) TWX and FIAR initiated 3/29/72

(2) Final FIAR to be scheduled following vendor part analysis.

c. FAR/FIAR Items Closed During March 1972

(1) FIAR AA-EH-000E7, LMS S/N-5, Array E Qual

Following LMS op-vib test, channels 5 and 6 of LMS housekeeping data were out of tolerance. BxA trouble-shooting per DR #AC 4159 isolated a ground loop problem. Shield connection instructions in the test procedures will correct the O/T conditions.

Status: Closed

Action: (1) TWX and FIAR initiated 2/8/72

(2) Final FIAR issued 3/2/72

(3) LSPO closeout letter issued 3/21/72

(2) FIAR AA-EH-000E9, LMS S/N-5, Array E Qual

During the LMS op-vib test, there was a loss of all experiment power during vibration. Trouble was isolated per BxA DR #AC 3712 to a manganin wire connection in the LMS cable. Changes were issued to add epoxy to the manganin solder joints to improve mechanical strength.

Status: Closed

Action: (1) FR/FIAR issued 2/11/72

(2) Final FIAR issued 2/17/72

(3) LSPO closeout letter issued 3/10/72

(3) FIAR AA-EH-00E10, LMS S/N-5, Array E Qual

During review of data obtained from X and Z axis operating vibration, it was discovered that some science data was O/T. The problem was traced to a broken interconnect wire between modules. DR #AC 4494. Epoxy tiedowns of wires will prevent motion of affected leads during vibration.

Status: Closed

Action: (1) FR/FIAR initiated 2/23/72

(2) Final FIAR issued 3/1/72

(3) LSPO closeout letter issued 3/21/72.

S. J. Ellison, Manager
ALSEP Reliability

b:8056

Internal
Memorandum

Bendix Aerospace Systems Division

Date 7 April 1972 Letter No 72-210-147 Ann Arbor Michigan

To T.W. Fenske

From L. Deck

Subject ALSEP Configuration Management - March Monthly Progress Review Input

Reference: Memo 72-210-013

ALSEP CHANGE ACTIVITY STATUS

The ALSEP Change Control Board has approved 142 changes for the period of 1 March thru 31 March for a total of 8872 changes for the period beginning the last week of November 1966 thru 31 March 1972.

ALSEP ARRAY E PDR CHIT ITEM STATUS

Total Chits Generated	45
Total Chits Approved	28
Total Chits Disapproved	10
Total Chits Not a Design Change	6
Total Chits Deferred	1

The following is the status of the approved, deferred, and not a design change chits as of 31 March 1972.

Total Chits Open	1
Total Closed	33

ALSEP ARRAY E CDR CHIT ITEM STATUS

Total Chits Generated	34
Total Chits Approved	28
Total Chits Disapproved	3
Total Chits Deferred	2
Total Chits No Disposition	1

The following is the status of the twenty nine (29) approved, two (2) deferred and one (1) no disposition chits as of 31 March 1972.

RFC's Open	1
RFC's Closed	30

L. Deck

L. Deck
Configuration Management Group

LD:bg

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ALSEP PDR STATUS SUMMARY ARRAY E

RFC NO.	ABBREVIATED DESCRIPTION	Review Board Action	Date of Completion	Responsible Personnel	Status C-Closed O-Open	REMARKS
LE-1	Explosive Actuated Cutters Seem Unduly Complicated	Appvd.	2-18-71	L. Galan	C	CCO 303
LSGE -2	Change Design of Mass Change & Uncaging Sub-System	Appvd.	2-18-71	V. Hutton	C	CCO 301
LSGE -1	Noise Problem Exists in the Caging Control	Appvd.	2-18-71	V. Hutton	C	CCO 315
LSGE -3	Change the Free Mode Filter Input From Integration Output to Integration Input	Disappvd.	2-18-71			Further Investigation Closed Per CCO 28
LSGE -4	Add Single Pulse Capability to Screw Servo System. To be used with Coarse Screw	Appvd.	2-18-71	V. Hutton	C	CCO 286
LSG G-1	Change Electrostatic Parameters	Appvd.	2-18-71	K. Hei	C	CCO 314
LSG M-1	Torque Reqmt. for the Mass Changing Motor may be at least 5 Times Greater than Design can provide	Not a Design Change	2-18-71	B. Pilon	C	CCO 302
LSG M-2	Initiate Design Change in Heater Box to Revise Heater Winding Groove to Allow Light Post Hole to be Drilled	Appvd.	2-18-71	B. Pilon	C	CCO 287
E-1	BxA Drawing Reviewed does not provide for R&QA Sign Off on DVT & Proto Drawings	Disappvd.	2-18-71	D. Douthat		
E-2	Overload Circuit Protection for the Xmitters will Turn Operating Xmitter Off but not Apply Power to Other Xmitter	Disappvd.	2-18-71	D. Douthat		

RFC NO.	ABBREVIATED DESCRIPTION	Review Board Action	Date of Completion	Responsible Description	Status C-Closed O-Open	REMARKS
E-3	EEE Parts Program Plan for Array E Requires Pre-cap Inspection for all Semiconductors	Disappvd.	2-18-71		Re-opened C	EH 3/4-7/6175 B205 EH 137/ B239
E-4	Design of Redundant PCU PDU Requires Relays in Both PDUs be Pre-Set Prior to Launch	Disappvd.	2-18-71			
DI-1	Test Results to Date. Indicate Unacceptable LSP Antenna in Area of Susceptibility to LSP EMI	Appvd.	2-18-71	D. Fithian	C	CCO 305
DI-2	Command Decoder Generates a "Switch Uplink Chain" Pulse at Periodic Intervals	Appvd.	2-18-71	D. Fithian	C	CCO 290
STC -1	BxA Does Not Plan to Vibrate Array E System to the 10 Sec. 5 Hz Dwell Reqmt. Specified	Appvd.	2-18-71	J. McNaughton	C	CCO 285
ML -1	UHT Socket on LMS Designed Differently from Other ALSEP UHT Sockets	Deferred	2-18-71	P. Georg-opulos	C	CCO 313
LMS -01	BxA Schedule does not allow for absolute Analyser Calibration BxA Revise to Include Calibration	Appvd.	2-18-71	R. Ormsby	C	CCO 294
LMS -02	LMS Design for Low Voltage PWR Supply not in Compliance with DS-13 for Reverse Polarity Protection	Appvd.	2-18-71	R. Ormsby	C	CCO 277
LMS -03	Insert Vs. Through Holes in Baseplate for Analyzer Tube	Disappvd.	2-19-71			

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RFC NO.	ABBREVIATED DESCRIPTION	Review Board Action	Date of Completion	Responsible Personnel	Status C-Closed O-Open	REMARKS
LMS -04	Eliminate B&C Testing of Electronic Components	Disappvd.	2-19-71			
LMS -05	R&QA Sign Off of Proto Drawings Ref. Chit E-1	Disappvd.	2-19-71			
LMS -06	Polywire PC Boards Vs. Plated thru Holes	Disappvd.	2-19-71			
LMS -07	No Documented LMS EMI Control Plan Presented at PDR	Not a Design Change	2-19-71	R. Ormsby	C	Bx PO 4102 4438
LMS -08	Provide Specific Workmanship Reqmts. for High Voltage Applications to Preclude Problems such as Corona	Appvd.	2-19-71	R. Ormsby	C	CCO 308
LMS -09	Provide Dust Cover for Breakseal after Breakseal has been operated by Astronaut	Appvd.	2-19-71	R. Ormsby	C	CCO 295
LMS -10	If High Voltage Circuits and Ion Pump are on when Exp. PWR is turned off, it appears that these circuits remain in On Condition. Therefore, Initial Turn On Conditions are not Automatically Set Up	Appvd.	2-19-71	R. Ormsby	C	CCO 296
LMS -11	Provide Outgassing Ports in Mtg. Supports for Electronic Cards	Appvd.	2-19-71	R. Ormsby	C	CCO 278
LMS -12	Expand Voltage Monitor of Mult. High Voltage so that 0 to 5 Volts Output Corresponds to 0 to 3200 Volts	Appvd.	2-19-71	R. Ormsby	C	

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RFC NO.	ABBREVIATED DESCRIPTION	Review Board Action	Date of Completion	Responsible Personnel	Status C-Closed O-Open	REMARK
LMS -13	Various Parts of Chassis are Electrically Isolated by Anodized Surfaces. Provide Connections for all Mechanical Sections	Appvd.	2-19-71	R. Ormsby	C	CCO 280
LMS -14	Recalculate Baseplates Deflections Exceeding Specification	Appvd.	2-19-71	R. Ormsby	C	CCO 297
EP-1	BxA Provide 2 Mod Kits & Instructions to GE for Standard Deutsch Connector	Appvd.	2-19-71	D. Courtois	C	CCO 307
LF/LSP -1	LT. WT. Model Should have Flt. Envelope. WT and Interface Compatible with Normal Operations on LM & LRV	Not a Design Change	2-19-71	P. Georgopulos	C	MSC LTR EH2/5-17, B253
EI-1	Heater Command Logic Uses Hrt. Pwr. Return Instead of Digital Signal Return	Appvd.	2-19-71	L. Galan	C	CCO 304
MI-2	Review Array E Vibration Characteristics to Assure the Envelope Delivered to the PSE Sensor will be within the Qual Envelope	Appvd.	2-19-71	J. McNaughton	I	BxPO 421 970-4551 Test Start 8-11-71
LSP-1	Design does not include means of properly verify Formatted Firing Pulse	Disappvd.	2-19-71			
LSP-2	Method of Pulling Safety Pins Provides Opportunity for Binding	Appvd.	2-19-71	J. Dye	C	CCO 293

RFC NO.	ABBREVIATED DESCRIPTION	Review Board Action	Date of Completion	Responsible Personnel	Status C-Closed O-Open	REMARKS
LSP-3	Method of Providing Secondary Retention of the Four Safety Pins during Transport does not appear sufficient	Appvd.	2-19-71	J. Dye	C	CCO 292
LSP-4	Provide Anchor Loop to Prevent Overturning of Module and Uprooting of Geophone	Appvd.	2-19-71	J. Dye	C	CCO 306
LSP-5	Quiet Site Calibration of LSPE Geophones is Required	Not a Design Change	2-19-71	J. Dye	C	BxPO 4019-970-4323
LSP-6	Not Planned to perform Operating VIB Test on Recvr. Explosives Module Electronics and Geophone Caged	Not a Design Change	2-19-71	J. Dye	C	EH2/6-1/L322 B266
LSP-7	Provide Test Plan for Thermal Battery Development	Not a Design Change	2-19-71	J. Dye	C	BxPO 4046-71-970-4350
PSE-1	Provide Interface Spec. & Location in LM for Decoupled Shroud	Appvd.	2-19-71	D. Breseke	C	CCO 281
PSE-2	Provide Weights on Decoupled Shroud	Appvd.	2-19-71	D. Breseke	C	CCO 282
PSE-3	Evaluate the Effect of Venting the PSE Caging Gas under the Decoupled Shroud	Appvd.	2-19-71	D. Breseke	C	CCO 283
PSE-4	Provide Full Dwg. Sign Off on PSE Decoupled Shroud Dwgs.	Appvd.	2-19-71	D. Breseke	C	CCO 284

ALSEP ARRAY E CDR RFC SUMMARY

RFC NO.	ABBREVIATED DESCRIPTION	Review Board Action	Date of Completion	Responsible Personnel	Status C-Closed O-Open	REMARKS
STC-1	Cable Strain Relief not planned for Array E. BxA to Implement Strain Relief ASAP	Appvd.	6-18-71	J. McNaughton	C	CCO 325
STC-2	Redundant Microswitches in Shorting Plug to Insure Proper RTG Shorting is not Req'd. BxA to Retain and Wire in Series	Appvd.	6-18-71	D. Douthat	C	CCO 339
STC-3	No Planned Qual Test of Carry Bar BxA to Provide Plan by 15 July 1971	Appvd.	6-18-71	J. McNaughton	C	Bx PO 4480 970-4828
STC-4	BxA does not plan to perform Hot/Cold Functional Check of Angenna Aiming Mech. BxA to Provide Test Plan/ Impacts by 15 July 1971.	Appvd.	6-18-71	J. McNaughton	C	Bx PO 4397 970-4739
E-1	BxA will Implement Method of C/S Component Removal Under Thermal Greased Conditions	Appvd.	6-18-71	D. Douthat	C	BxPO 4397 71-970-473
E-2	Non-released C/S Drawings will be reviewed at later date	Appvd.	6-18-71	D. Douthat	O	
E-3	Three Alternatives for Locating the Uplink 15V Energy Storage Components which hold the Existing State during Switch Over from one side to the other	Appvd.	6-18-71	D. Douthat	C	CCO 331
E-8	Thermal Bag Inner Multilayer Bag Temp. Sensor (HK-60) Design Change to be Implemented for Narrow Band Internal Measurement	Appvd.	6-18-71	R. Howell	C	CCO 322
LF-1	UHT Socket on Proto Unsatisfactory BxA to run tests on Crew Mockup. Results due 7/15/71	Appvd.	6-18-71	L. Galan	C	BxPO 4442 71-970-4788

RFC NO.	ABBREVIATED DESCRIPTION	Review Board Action	Date of Completion	Responsible Personnel	Status C-Closed O-Open	REMAR
LE-2	Determine Second Source of Operational Amplifiers with Design, Cost and Schedule Impact	Appvd.	6-18-71	L. Galan	C	BxPO 4348-71-970-4689
LE-3	Use of PSE Type Connector be Evaluated for Entire System	Appvd.	6-18-71	L. Galan	C	BxPO 4465-71-970-4813
LSG CDR-1	LSG Calibration at a Site with Wider Range of G Difference	Appvd.	6-18-71	K. Hsi	C	CCO 316
LSG CDR-2	Verify that Firing for LSP cannot Perturb the Level (3°) Adjustment of the LSG	Appvd.	6-18-71	K. Hsi & MSC	C	CCO 317
LSG CDR-3	Modify Seismic Amplifier so that it "Soft Limits" at about 6 Volts Output	Appvd.	6-18-71	K. Hsi	C	CCO 318
LSG CDR-4	Add Measurements of Magnetic Field Inside the Htr. Box and at the Htr. Box Location	Appvd.	6-18-71	K. Hsi	C	CCO 319
LSG CDR-5	Perform Temp. (Low-High) Tests in LSG Electronics and Htr. Box/ Electronics Assy. Perform EMI on Engr. Model to Determine Acceptability of LSG	Appvd.	6-18-71	K. Hsi	C	CCO 320
LSG CDR-6	After Completion of LSG Qualification, Allocate BxA to Provide Contingency Plan	Disappvd.	6-18-71			
LSG CDR-7	Test Electronics of Qual & Flt. Model with Simulator for Close D Loop Operation Noise Performance in Free Modes Filter Band Width	Appvd.	6-18-71	K. Hsi	C	CCO 337

IFC NO	ABBREVIATED DESCRIPTION	Review Board Action	Date of Completion	Responsible Personnel	Status C-Closed O-Open	REMARKS
LMS-3	Dwg. 2347430 should Specify Dimension for Insulation Termination	Appvd.	6-18-71	R. Ormsby	C	BxPO 4352-71-970-4694
LMS-6	Encapsulation of Hi-voltage Multiplier BxA to Review UTD Recommendations	Deferred	6-18-71	R. Ormsby	C	CCO 335
LMS-7	Prevent Possibility of ARC at Flatpack Interconnections. Add Solethane or Kapton Layers	See LMS-6	6-18-71	R. Ormsby	C	CCO 335
LMS-12	No Stress Relief or Spacers used on Semi-Conductors Mounting of CK05, C6 Capacitors Require Heat Sinking & Stress Relief	Appvd.	6-18-71	R. Ormsby	C	CCO 328
LMS-13	Test Coupons for Inspecting Hole Wall Plating Thickness are not included as part of PWB Art Masters	Disappvd.	6-18-71			
LMS-14	Dwgs. do not Specify Cleaning and Handling Procedures for BxA Built Components & End Items	-	6-18-71		C	EH 2/9-4/L452/ B410.
LMS-17	Dwg. 2347429 Violates NHB 5300.4(3A) for Wire Splice & Lap Solder Joints BxA to Submit Waivers	Appvd.	6-18-71	R. Ormsby	C	CCO 323
LMS-18	Dwg. [illegible] Length of Wire, needs Installation Note for Fastener Torque Note Missing	Appvd.	6-18-71	R. Ormsby	C	Appvd. for Torq Note
LMS-19	Add Terminals to Baseplate to Interconnect Multipliers & Ion Pump. Add Locking Insert to Baseplate for Thermistor Revise ICD to Agree	Appvd.	6-18-71	R. Ormsby	C	CCO 329

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RFC NO.	ABBREVIATED DESCRIPTION	Review Board Action	Date of Completion	Responsible Personnel	Status C-Closed O-Open	REMARKS
LMS-20	Complete Design of Lockout Device for LMS Filament Protection. Incorporate into all Affected LMS ICDs	Appvd.	6-18-71	R. Ormsby	C	BxPO 4352-71-970-4694
HFE-1	Incorporate ECP-009F into Exhibit B	Appvd.	6-18-71	B. Smith	C	MSC to Subm ECP-009 Appvd. to Bx
SS-2	Extend Field Support to Cover Apollo 17 BxA to Submit Plan & Impacts by 9/15/71	Appvd.	6-18-71	C. Murtaugh	C	Bx Contracts Ltr. 71-140-SS-097
LSP-1	BxA Propose Design Changes to Experiment which would Allow Operation without Crew Activity during first EVA.	Disappvd.	6-18-71	J. Dye		
LSP-2	Add 4 Geophone Flag/Anchors of the ASE Design to the LSPE	Appvd.	6-18-71	J. Dye	C	CCO 334
LSP-3	Delete Stand Off Legs from the Explosives Pkg.	Appvd.	6-18-71	J. Dye	C	BxPO 4358-970-4700
LSP-4	Eliminate Sticking of Geophone Module to Ecrofoam Rim at Base of Geophone Module Case	Appvd.	6-18-71	J. Dye	C	CCO 333